



FUNDAMENTAL UNIT OF LIFE



BL-1

CELL

- All living forms are composed of microscopic units called as "Cells".
- A cell is the basic structural and functional unit of all life forms.
- Study of structure and composition of cell is called as "Cytology".
- Cell was first observed by "Robert Hooke" in a dead cork slice in the year 1665. He described about this in his book "Micrographia".
- The word cell was derived from a Greek word "Cellulae" which means small room.
- First living cell was discovered by A.V. Leeuwenhoek.
- The term protoplasm was coined by Purkinje in 1839.
- Protoplasm was discovered by "Felix Dujardin" and named as sarcodes.
- Its consistency differs under different conditions. It exists in sol-gel states.
- Protoplasm is an aggregate of various chemicals such as water, ions, salts and other organic molecules like proteins, carbohydrates, fats, nucleic acids, vitamins etc.

CELL THEORY

Two biologists, "Schleiden and Schwann" gave the "Cell theory" which was later on expanded by "Rudolf Virchow". Cell theory states that

- (i) All plants and animals are composed of cells.
 - (ii) Cell is the basic unit of life.
 - (iii) All cells arise from pre-existing cells.
- Viruses are the exceptions of cell theory.

TYPES OF CELL & ORGANISM

(a) On the Basis of Number of Cells Organisms can be categorized as:

- (i) Unicellular organisms: These are organisms which are made up of single cell only. This single cell performs all the vital body functions of an organism. e.g. **Amoeba**
- (ii) Multicellular organisms: These are the organisms which are made up of numerous cells. These cells then combine to form an organ and a group of organs performing different functions forms an organ system which further forms an organism. e.g. plants and animals

(b) On the basis of type of organization, cells are two types :

- (i) Prokaryotic cells: these are primitive and incomplete cells. They have less developed nucleus without nuclear membrane & nucleolus. e.g. **Bacteria**.

- (ii) Eukaryotic cells: these are well developed cells. They have advanced nucleus with nuclear membrane and nucleolus. e.g. **Plants & animals.**

CELL SHAPE

Cells are of variable shapes and sizes. Their shape is according to the function. Generally cells are spherical but they may be elongated (nerve cell), branched (pigmented), discoidal (RBC), spindle shaped (muscle cell) etc.

CELL SIZE

Size of cell is variable depending upon the type of organism. Some are microscopic while some are visible with naked eyes.

Their size may vary from $0.2\ \mu\text{m}$ to 18 cm.

- Size of a typical cell in a Multicellular organism ranges from 20-30 μm .
- The largest cell is ostrich egg (15 cm. in dia with shell & 8 cm. in dia without shell)
- The longest cell is nerve cell. (upto 1m. or more)
- Smallest cells so far known are PPOs e.g. mycoplasma ($0.1\ \mu\text{m}$ in dia.)
- Human egg is 0.1 mm. in dia.

COMPONENTS OF CELL

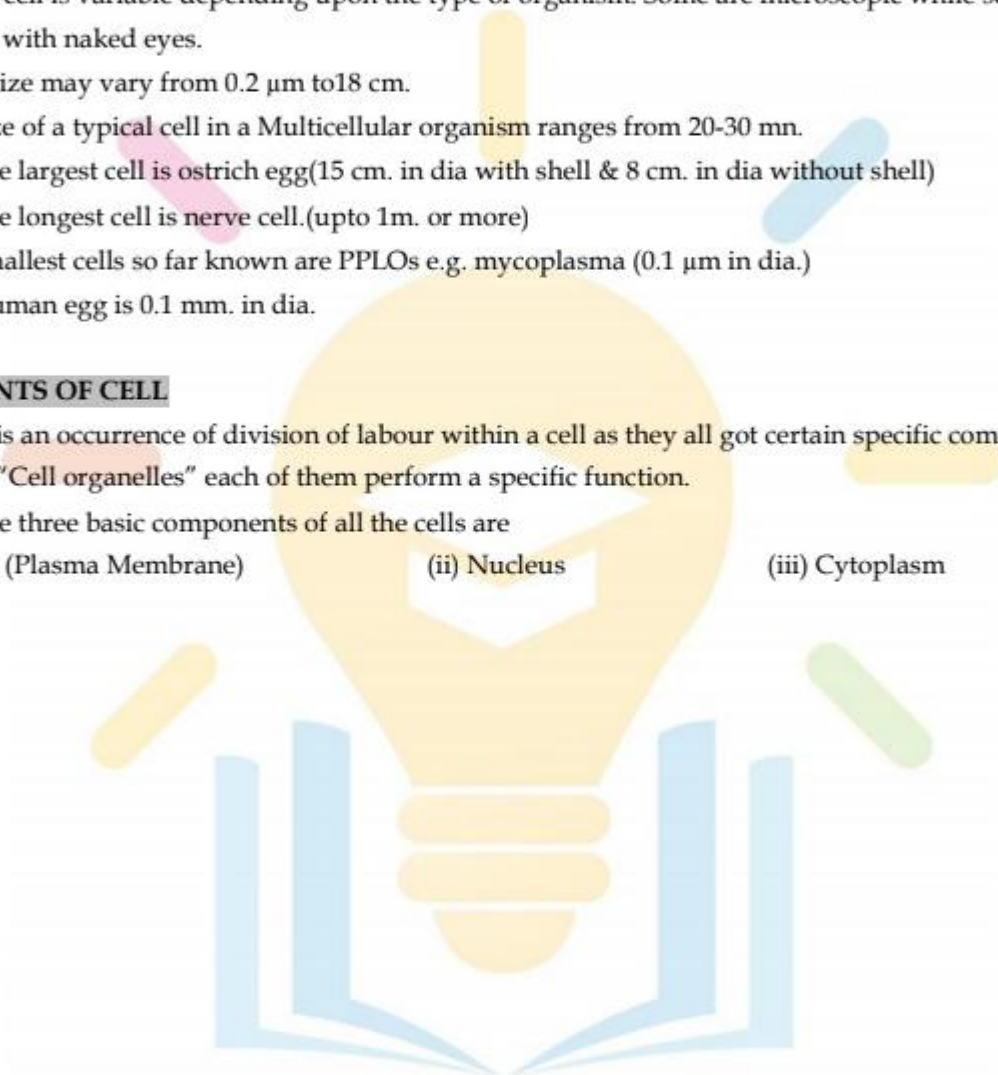
There is an occurrence of division of labour within a cell as they all got certain specific components called "Cell organelles" each of them perform a specific function.

- The three basic components of all the cells are

(i) PM (Plasma Membrane)

(ii) Nucleus

(iii) Cytoplasm



EXERCISE

OBJECTIVE DPP - 1.1

- The first person to observe a cell under microscope was
(A) M. Schleiden (B) T. Schwann (C) Robert Hook (D) A.V.Leeuwenhoek
- Cell theory was propounded by
(A) Morgan (B) Halden
(C) Schleiden and Schwann (D) Robert Hooke
- The word cell was coined by
(A) Robert hooke (B) Weismann (C) Cuvier (D) Darwin
- Nucleus discovered by
(A) Robert Hooke (B) Robert Brown (C) Dujardin (D) Purkinje
- Smallest cells so far known are
(A) Bacteria (B) blue green algae (C) PPOs (D) human egg
- Which of the following is the longest cell of animal kingdom?
(A) Bacteria (B) Nerve cell (C) Virus (D) Muscle cell
- Which one of the following is an example of prokaryotic cell?
(A) Typical plant cell (B) Typical animal cell (C) Bacteria (D) None of these
- What is cytology?
(A) Study of cytoplasm (B) Study of structure and composition of cell
(C) Study of animal cell only (D) Study of cell only
- Who coined term protoplasm?
(A) Leeuwenhoek (B) Purkinje (C) Robert hooke (D) Robert Brown
- Cell is
(A) Functional unit of life (B) Structural unit of life
(C) Hereditary unit of life (D) all of the above

SUBJECTIVE DPP - 1.2

VERY SHORT ANSWER TYPE QUESTIONS

1. Name the largest cell of living world.
2. Amoeba is a organism.
3. Who wrote the book "Micrographia"?

SHORT ANSWER TYPE QUESTIONS

4. What is the composition of protoplasm?
5. Define cell.

LONG ANSWER TYPE QUESTION

6. Who gave the cell theory? What does it state? Which organism is an exception of cell theory?

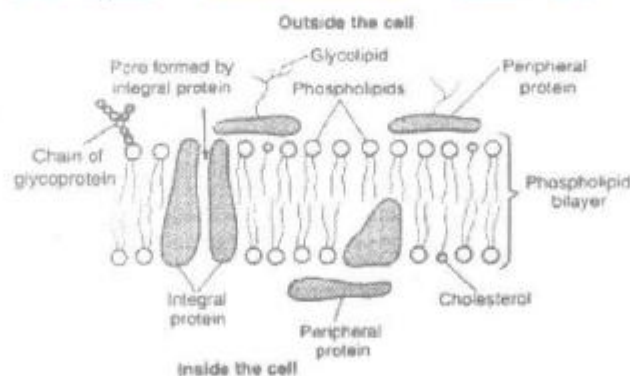
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BL-2

CELL MEMBRANE

(a) Cell Membrane:

- Cell membrane is also called as plasma Membrane or Plasma lemma.
- It is the limiting boundary of each cell which separates the cytoplasm from its surroundings.
- It is found in both plant as well as animal cells.
- It is the outer most covering of a cell in case of animals and lies below the cell wall in case of plants.
- It is made up of proteins and lipids where proteins are sandwiched between bilayer of lipids.
- Plasma membrane name was given by Nageli.
- Plasma membrane is selectively permeable in nature. It allows or permits the entry and exit of some materials in and out of the cell.
- **Singer and Nicholson** gave the fluid mosaic model of plasma membrane according to him it consists of a protein layer sandwiched between two layers of lipids. It is in quasifluid state. It is 75A thick.
- It is flexible and can be folded, broken and reunited.



(i) Function of plasma membrane:

- (A) It regulates the movement of molecules inside and outside the cell.
- (B) It helps in maintaining the distinct composition of the cell.

(ii) Transportation of molecules across the plasma membrane: This can be done by following ways:

- (A) **Diffusion:** Movement of solutes or ions from higher concentration to lower concentration is called as diffusion. It does not require energy therefore it is called as passive transport.

(B) **Osmosis:** The movement of solvent or water from higher concentration (solvent) to lower concentration (solvent) through a semipermeable membrane is called as osmosis. Or The movement of solvent or water from lower concentration to higher concentration of solution through a semipermeable membrane is called as osmosis. Osmosis can also be called as diffusion of solvents”.

- **Endosmosis:** Movement of solvent into the cell is called as Endosmosis.
- **Exosmosis:** Movement of solvent outside the cell is called as Exosmosis.

(iii) **Types of solution on the basis of concentration:**

(A) **Isotonic solution:** When the concentration of the solution outside the equal to the Concentration of cytoplasm of the cell it is called as isotonic solution.

(B) **Hypertonic solution:** When the concentration of the solution outside the cell is more than that inside the cell. Due to this cell loses water and becomes plasmolysed.

(C) **Hypotonic solution:** When the concentration of the solution outside the cell is lesser than that of cytoplasm of cell. Due to this cell swells up and bursts.

(b) **Cell Wall:**

- It is the outermost covering of the plant cells.
- It is absent in animal cells.
- Cell wall is rigid, strong, thick, porous and non living structure. It is made up of cellulose and hemicelluloses. Cell walls of two adjacent cells are joined by a layer called middle lamellae. It is made up of calcium and magnesium pectate.
- Functions of cell wall:
 - It provides definite shape to the cell.
 - It provides strength to the cell.
 - It is permeable and allows entry of molecules of different sizes.
 - It is antigen specific.
 - It has the characteristics of repair and regeneration.

(c) **Nucleus:**

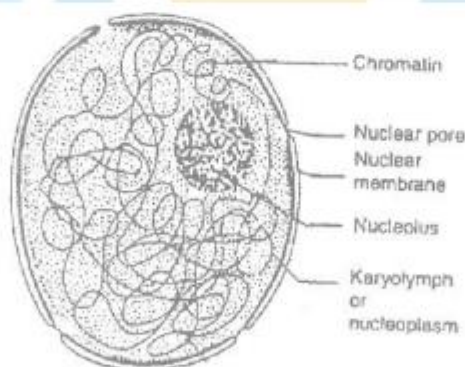


Figure: Nucleus

- Nucleus is the most important cell organelle which directs and controls all its cellular activities.
- It is called as “Headquarter of the cell”.
- It was discovered by “Robert Brown in 1831”.
- In eukaryotes a well defined nucleus is present while in prokaryotes a well defined nucleus is absent.
- Prokaryotes contain a primitive nucleus.
- It has double layered covering called as nuclear membrane.

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- Nuclear membrane has pores which regulate the movement of materials in & out of the cell.
 - Besides nuclear membrane nucleus also contains nucleolus and chromatin material and the substance filled inside the nucleus is nucleolus or karyolymph.
 - Chromosomes or chromatin material consists of DNA which stores and transmits hereditary information for the cell to function, grow and reproduce.
 - (i) Function of the nucleus:
 - (A) It controls all the metabolic activities of the cell and regulates the cell cycle.
 - (B) It helps in transmission of hereditary characters from parents to off springs

EXERCISE

OBJECTIVE DPP - 2.1

- Plasma membrane is made up of
 - Proteins and carbohydrates
 - Proteins and lipids
 - Proteins and nucleic acids
 - Proteins, some nucleic acids and lipids
- Plant cell wall is mainly composed of
 - Sugars
 - Cellulose
 - Proteins
 - lipids
- Nucleus was discovered of
 - Robert Brown
 - Robert Hooke
 - A.V. Leeuwenhoek
 - Schwann
- A solution is said to be hypotonic when
 - Concentration of medium is higher than that of the cell
 - Concentration of medium is equal to that of the cell
 - Concentration of medium is lower than that of the cell
 - None of the above are correct.
- Cell wall shows
 - Complete permeability
 - semipermeability
 - Differential permeability
 - impermeability
- Plasma membrane is -
 - Impermeable
 - formed of cellulose
 - selectively permeable
 - nonselective
- Ribosome was named by -
 - Palade
 - Porter
 - de Duve
 - Koliker
- Ribosome consist of -
 - DNA and protein
 - RNA and protein
 - RNA and amino acids
 - RNA and DNA
- The solution having concentration equal to the concentration of solution of inside the cell is called as
 - Isotonic solution
 - hypotonic solution
 - Hypertonic solution
 - all of the above
- .If a cell will be placed in hypotonic solution what will happen to it ?
 - The cell will swell and burst
 - The cell will become flaccid
 - It will remain unchanged
 - None of the above

SUBJECTIVE QUESTION - 2.2

VERY SHORT ANSWER TYPE QUESTIONS

1. Who gave the fluid mosaic model of plasma membrane ?
2. Movement of solvent into the cell is called as.....
3. Which cell organelle is called as the head quarter of cell?

SHORT ANSWER TYPE QUESTIONS

4. What is the difference between diffusion and osmosis?
5. Why plasma membrane is called as selectively permeable membrane ?

LONG ANSWER TYPE THE QUESTION

6. Draw a neat and labeled diagram of nucleus. State its main function.



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BL-3

CYTOPLASM

- Cytoplasm was discovered by Kolliker in 1862.
- It is the site of both biosynthetic and catabolic pathways.
- It can be divided into two parts:
 - (i) Cytosol: Aqueous soluble part contains various fibrous proteins forming cytoskeleton.
 - (ii) Cell organelles: Living part of the cells having definite shape, structure and function bounded By Plasma membrane.

ENDOPLASMIC RETICULUM

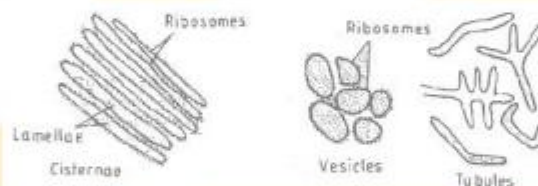
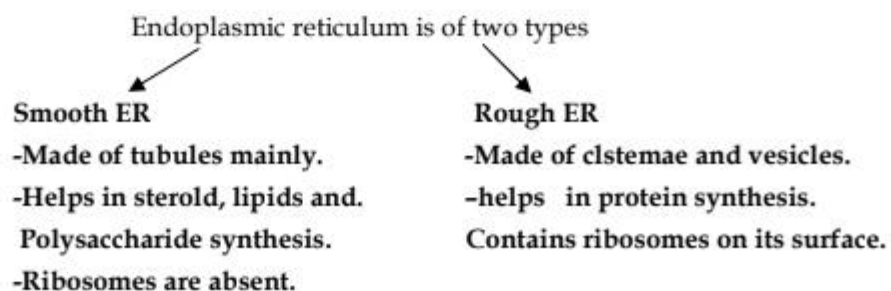


Figure: Endoplasmic Reticulum

- It is the network of membranes present in the cytoplasm.
 - It was discovered by Porter, Claude and Fullam.
 - These are present in all cells except prokaryotes and mammalian erythrocytes.
 - They are made up of three components:
 - (i) **Cisternae**: These are long, flattened, parallelly arranged, unbranched tubules. These are found in successive layers of nucleus. These are found in cells which are active in protein synthesis and are 40-50 μm in diameter.
 - (ii) **Vesicles**: These are round or spherical they are found in synthetically active cells.
- (a) **Types :**



-Helps in membrane biogenesis.

(b) Function of ER:

- (i) It is the only organelle which can move within a cell so it serves as a channel for the transport of materials between various regions of cytoplasm and between cytoplasm and nucleus.
- (ii) It also function as a cytoplasmic framework to provide space for some of the biochemical activities. It forms endoskeleton of cell.
- (iii) It helps in synthesis of fats, steroids, cholesterol etc.
- (iv) It contains secretory proteins.
- (v) SER plays a crucial role in detoxification of drugs and poisonous by-products.

GOLGI APPARATUS

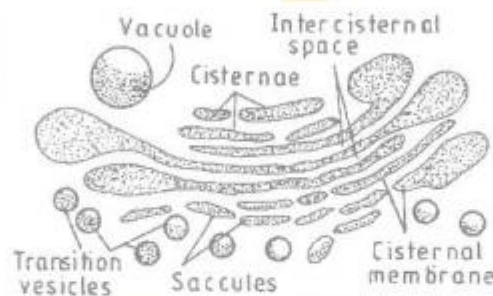


Figure: Golgi apparatus

- Golgi apparatus consists of a system of membrane bounded vesicles arranged parallel to each other in stacks called Cisternae along with some large and spherical vacuoles.
- It was discovered by Camilo Golgi.
- In plants Golgi membrane bounded.
- It is single membrane bounded.
- It is absent in prokaryotes, mammalian RBC's & sieve cells.

(a) Functions:

- (i) It helps in formation of lipids
- (ii) It helps in formation of middle lamellae
- (iii) It is secretory in nature.
- (iv) It helps in melanin synthesis
- (v) Lipids and proteins synthesized in endoplasmic reticulum are packed at Golgi complex. They provide the site for assembly of new membrane material.

MITOCHONDRIA

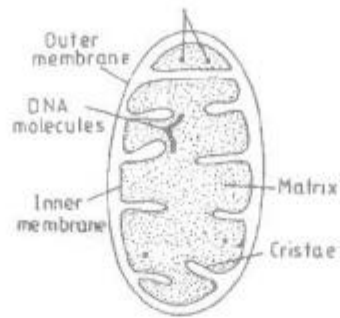


Figure: Mitochondria

- It is a rod shaped structure found in cytoplasm of all eukaryotic cells except mammalian RBC's.
- These are also absent in prokaryotes.
- It was first seen by Kolliker in insect cells.
- Maximum mitochondria are found in metabolically active cells.
- It is also called as "Power House of the Cell" or the "Storage Battery".
- It is double membranous structure where outer membrane has specific proteins. While inner membrane is folded inside to form chambers called Cristae. "Cristae" are the infoldings of inner mitochondrial membrane that possess enzymes for respiratory cycles like Krebs Cycle. ATP synthesizing units are called Oxysomes or F_1 particles.
- Space between inner and outer mitochondrial membranes is called as Perimitochondrial space. The fluid present in mitochondrial is called as matrix.

(a) Functions:

- (i) Its main function is to produce and store the energy in the form of ATP.
- (ii) It is the site of Krebs cycle of respiration.
- (iii) Oxysome contains enzymes for ATP production.
- (iv) Matrix contains enzymes for Krebs cycle.

RIBOSOMES

Ribosomes are the sites of protein synthesis.

All structural and functional proteins (enzymes) coded by the nuclear DNA, are synthesized upon cytoplasmic ribosomes. The DNA codes are transcribed into messenger RNA (mRNA) molecules in the chromosomes of the nucleus. mRNA molecules diffuse out into the cytoplasm and each becomes attached to several ribosomes which thus form a group called polyribosome or polyribosomes. In this way each mRNA molecule brings about polymerization of specific protein molecules, with the help of ribosomes from amino acid molecules found in the Cytosol.

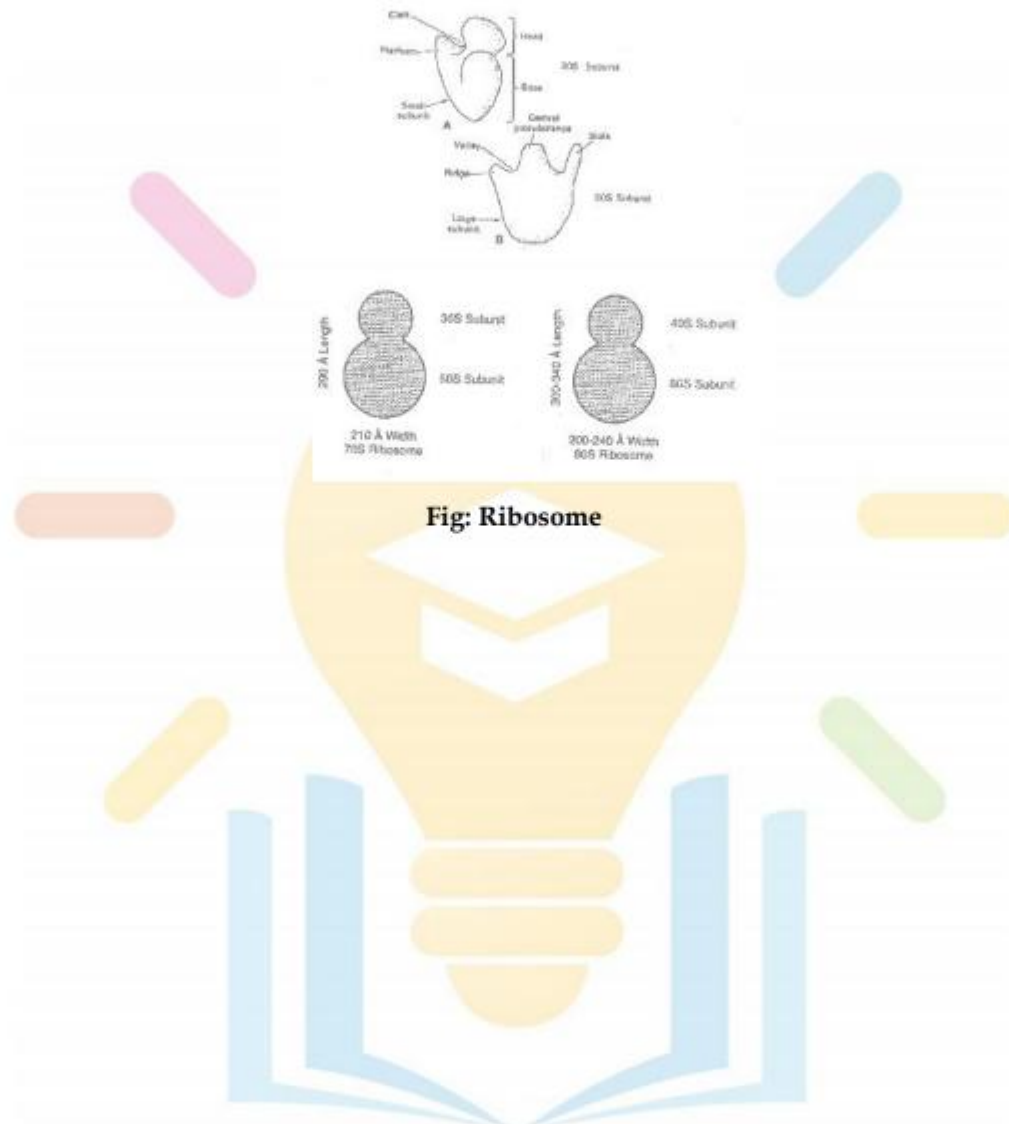


Fig: Ribosome

EXERCISE

OBJECTIVE DPP- 3.1

- What is more abundant in smooth endoplasmic reticulum?
(A) Cisternae and vesicles (B) Tubules
(B) Tubules and vesicles (C) Cisternae
- Mitochondria are concerned with
(A) Krebs cycle (B) C₃ cycle (C) glycolysis (D) none of the above
- Which of the following organelle is the site of Krebs cycle?
(A) Ribosomes (B) Lysosomes (C) eukaryotic cells (D) Nucleus
- Mitochondria are absent in
(A) Prokaryotic cells (B) RBC of mammals (C) eukaryotic cells (D) (A) and (B) Both
- Mitochondria stores energy in form of
(A) Heat energy (B) ATP (C) light energy (D) none of the above
- The ATP synthesizing units of Mitochondria are
(A) Oxysomes (B) peroxysomes (C) glyoxysomes (D) lysosomes
- Lipid synthesis is performed by
(A) Rough ER (B) smooth ER (C) both of above (D) none of the above
- Who observed Mitochondria at first?
(A) Porter (B) Palade (C) Koliker (D) Camilo Golgi
- Detoxification of body is done by?
(A) Mitochondria (B) lysosomes
(C) Smooth endoplasmic reticulum (D) rough endoplasmic reticulum
- Golgi apparatus is made of
(A) Cisternae (B) vesicles (C) golgian vacuoles (D) all of the above

SUBJECTIVE QUESTIONS - 3.2

VERY SHORT ANSWER TYPE QUESTIONS

- Which cell organelle is called as 'power house of cell'?
- Which cell organelle contains enzymes for ATP production?
- In mitochondria which portion contains specific proteins?

SHORT ANSWER TYPE QUESTIONS

- Define Cristae.
- State any two function of Golgi body.

LONG ANSWER TYPE QUESTION

- Describe the types of endoplasmic reticulum and draw necessary figure. Give it's main functions also.
- Draw a neat and labeled diagram of mitochondria.



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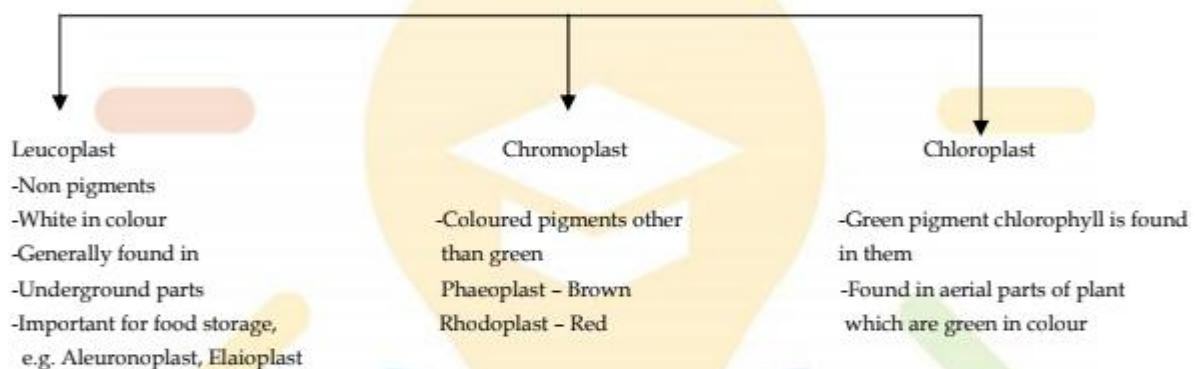


BL - 4

PLASTID

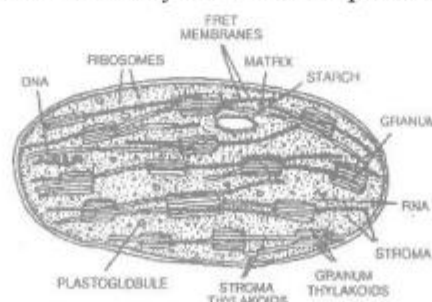
- It is double membranous discoidal structure, found only in plant cells.
- Term plastid was given by Haeckel.
- Chloroplast was discovered by A.V. Leeuwenhoek and named by Schimper.
- Besides being discoidal or rhombic in plant cells they occur in variable shapes like in algae they can be 'U' shaped, spiral, coiled, ribbon shaped etc.

Depending upon the type of pigment present in them they are of following three types.



(a) Chloroplast have Following Two Parts :

- (i) **Grana:** It constitutes the lamellar system. These are found layered on top of each other, these stacks are called as Grana. Each granum of the chloroplast is formed by superimposed closed compartments called Thylakoids.
- **Function:** They are the sites of light reaction of photosynthesis as they contain photosynthetic pigment chlorophyll. In each thylakoid Quantasomes are present which are called as Photosynthetic units. Each quantansome possesses 230 chlorophyll molecules.
- (ii) **Stroma:** It is a granular transparent substance also called as matrix. Grana are embedded in it. Besides Grana they also contain lipid droplets, starch grains, ribosomes etc.



- **Function:** This is the site of dark reaction of photosynthesis. Also helps in protein

synthesis due to presence of ribosomes.

VACUOLES

- These are membrane bounded regions in the cytoplasm containing water and other substances.
- They are bounded by a single membrane called Tonoplast.
- In animal cells vacuoles are smaller in size and numerous while in plant cells a single large vacuole is found which occupies about 90% of the volume of cell.

(a) Functions:

- It helps in maintaining osmotic pressure in a cell.
- It stores toxic metabolic products of plant cell.
- It contains various Coloured pigments like anthocyanins.

LYSOSOMES

(Discovery: Christian de Duve) (Lyso = digestive, some = body)

- These are tiny sac like granules containing enzymes of intracellular digestion.
- They are bounded by a single membrane.
- They occur in animal cells and a few plant cells.
- They do not have a definite shape or size.
- They contain hydrolyzing enzymes called **acid hydrolases**.

(a) FUNCTION :

- Their main function is phagy = digestion
- They are kind of waste disposal system.
- They help in digesting foreign materials and worn out cells.
- During disturbances in cellular metabolism i.e. in case of cell damage lysosomes burst and their enzymes are released into the cytoplasm and they digest their own cell so they are also called as "**Suicidal Bags**".



Fig: Lysosomes

PEROXISOMES

- These structures were first described from liver and kidney cells by Rodhin(1954)
- In plant cells, they were first observed in germinating seeds by Tolbert(1969)
- The term 'peroxisomes' was first used by de Duve and also called as uricosomes.
- Peroxisomes are ovoid or granular structures, limited by a single unit membrane and have a diameter of 0.5 to μm .
- In green leaves of C_3 plants, peroxisomes carry out photorespiration.
- In animal cells they carry out lipid metabolism.
- They contain important enzymes as oxidases (peroxide producing enzyme), peroxidases and catalases (which break down toxic peroxides to water and oxygen).

GLYOXYSOMES

- A beaver (1961) was the first person to discover these organelles and were described

later by **R.W. Briedenbach (1967)**.

- They are about 0.5 to 1 μm in size and are surrounded by a single unit membrane.
- They are found in plant cells, particularly, in germinating fatty seeds e.g. Ricinus (castor) and groundnut where fat is being converted into carbohydrates by a process called glyoxylate cycle.
- Glyoxysomes contain important enzymes, isocitrate, lyase, maltase and Synthelast along with several others.
- Structure of glyoxysomes is similar to peroxisome.

DIFFERENCES BETWEEN A PLANT CELL AND AN ANIMAL CELL

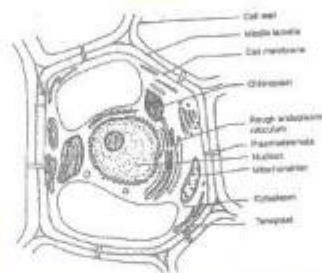


Figure: Plant cell

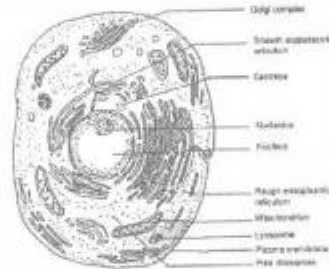


Figure: Animal cell

Plant Cell	Animal Cell
Cell wall is present	Cell wall is absent
Plastids are found	Plastids are absent
One large vacuole	Numerous tiny vacuoles are found
Centriole is absent	Centriole is present

ON THE BASIS OF TYPE ORGANIZATION CELLS CAN BE DIFFERENTIATED AS

Characters	Prokaryotic Cells	Eukaryotic Cells
1. Nuclear body	Incipient nucleus, No nuclear membrane Nucleolus absent' No mitosis Single closed loop, (histones absent)	True nucleus, Nucleolus membrane present Nucleolus present Mitosis found Multiple chromosomes, (histones present in chromosome)
2. Mitosis	No mitosis	Mitosis found

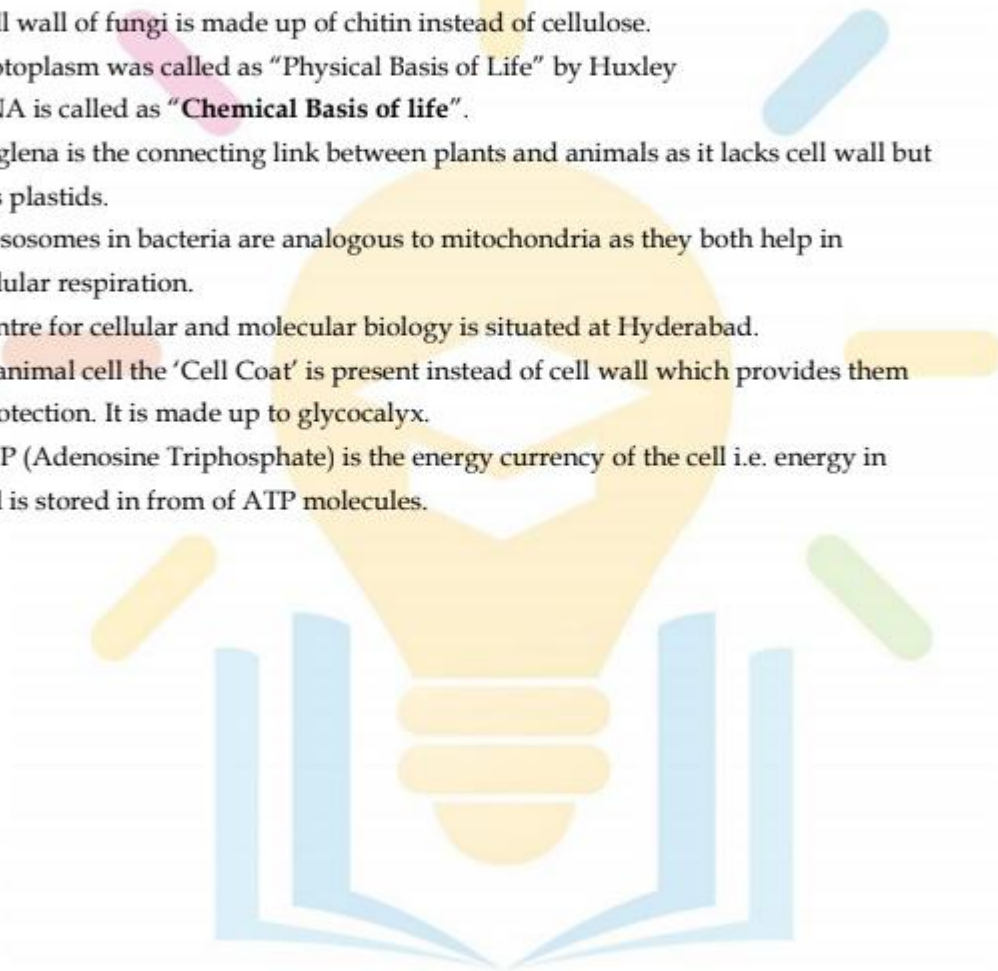
Characters	Prokaryotic cells	Eukaryotic cells
3. DNA arrangement	Single closed loop, (histones absent)	Multiple chromosomes, (histones present in chromosome)
4. Respiratory system	In plasma membrane, (mitochondria)	In mitochondria
5. Photosynthetic apparatus	In internal membranes, (chloroplasts absent)	In chloroplasts
6. Golgi bodies, chloroplast, Endoplasmic reticulum, Mitochondria, Lysosomes	Absent	Present
7. Ribosomes	70 S type	80 S type
8. Cell wall	Generally present, complex chemical composition	Present in some types, simple Chemical composition
9. Flagella	Submicroscopic, do not have 9+2 fibrillar structure	Microscopic size have 9+2 Fibrillar structure
10. Cytoplasmic movements	Cytoplasmic streaming rare of absent	Cytoplasmic streaming often occurs
11. Vacuoles	Absent	Present
12. Lysosome	Absent	Present
13. Capsule	May be present	Always absent
14. Hereditary material	DNA circular	DNA (linear)

SOME IMPORTANT POINTS

- (i) Centrioles :
- It is found in animal cell.
 - It consists of two centrioles.
 - It is non membranous.
 - It is made up of microtubules.
 - It helps in cell division and spindle formation.
- (ii) Cilia and flagella: These are thread like appendages used for locomotion and emerge from basal body.
- (iii) Chromosomes: These are thread like structures containing hereditary information in form of genes.
- (iv) There are four different types of membranes on the basis of permeability:
- (A) Permeable: They allow diffusion of both solvent and solute molecules or ions through them.
e.g. Cell wall of plant cell.
- (B) Impermeable: They prohibit the diffusion of both solvent and solute particles through them.
e.g. Cutinized cell wall, Lignified cell wall.
- (C) Semipermeable: Allows diffusion of solvent molecules but do not allow the passage of solute molecules. e.g. Parchment paper, Kidney membrane.
- (D) Differentially Permeable: It allows some solutes to pass through them along with the solvent molecules.

E.g. Plasmalemma, Tonoplast.

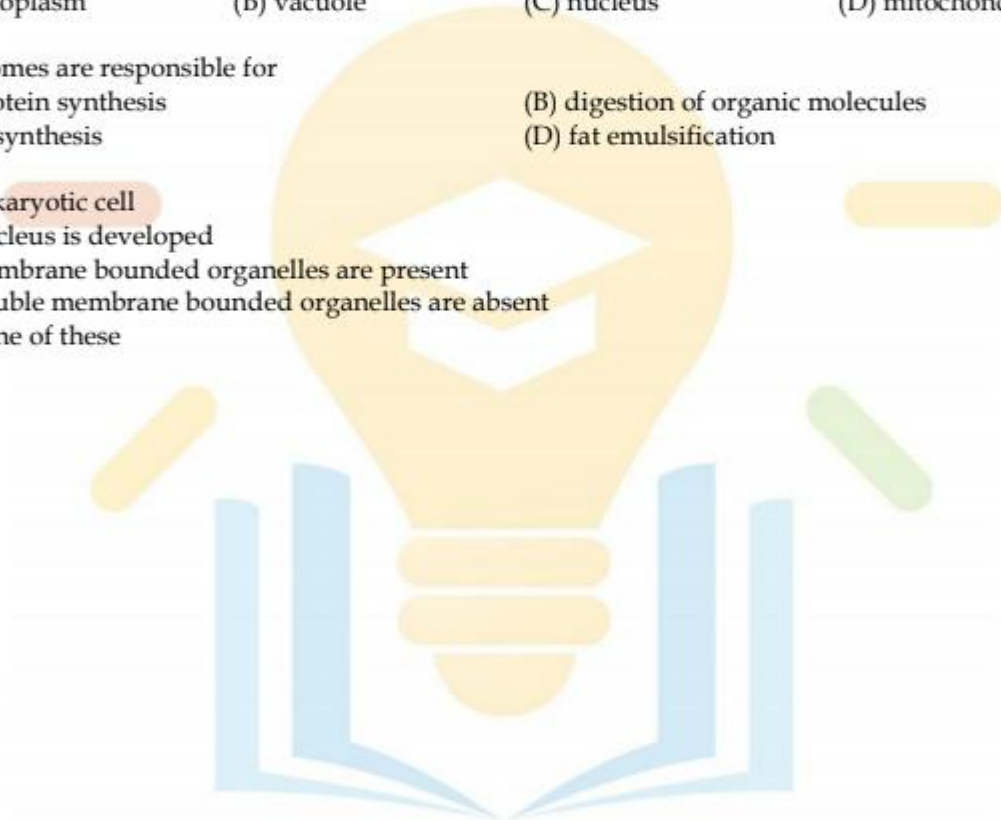
- Cell organelles can be separated by the method of differential centrifugation.
 - First cell that developed in laboratory by Sydney Fox and A.I. Oparin was called as Coacervate.
 - Smallest cell is Mycoplasma (PPLO)(0.1 μ dia)
 - Largest cell is Ostrich egg (15 cm.dia.)
 - Longest Animal Cell is Nerve fibre (1m.)
 - Lysosomes exhibit polymorphism i.e. they occur in different forms.
 - Mitochondria, plastid and centrioles have their own DNA molecules so they are called as "Semiautonomous Cell Organelles".
 - Connection through which cells communicate chemically with each other through their thick walls are called as "Plasmodesmata".
 - Cell wall of fungi is made up of chitin instead of cellulose.
 - Protoplasm was called as "Physical Basis of Life" by Huxley
 - DNA is called as "**Chemical Basis of life**".
 - Euglena is the connecting link between plants and animals as it lacks cell wall but has plastids.
 - Mesosomes in bacteria are analogous to mitochondria as they both help in cellular respiration.
 - Centre for cellular and molecular biology is situated at Hyderabad.
 - In animal cell the 'Cell Coat' is present instead of cell wall which provides them protection. It is made up to glycocalyx.
 - ATP (Adenosine Triphosphate) is the energy currency of the cell i.e. energy in cell is stored in form of ATP molecules.



EXERCISE

OBJECTIVE DPP - 4.1

- Which of the following is called as 'Suicidal bags' ?
(A) Centrosome (B) Lysosome (C) Microsome (D) Mesosomes
- Eukaryotic ribosomes are
(A) 30s (B) 50s (C) 80s (D) 70s
- Plastids that are white in colour (Pigment free)
(A) chloroplast (B) lysosome (C) leucoplast (D) Chromoplast
- Striking difference between a plant cell and an animal cell is due to the presence
(A) mitochondria (B) plasma membrane (C) cell wall (D) ribosome
- Tonoplast is the membrane surrounding the
(A) cytoplasm (B) vacuole (C) nucleus (D) mitochondria
- Lysosomes are responsible for
(A) protein synthesis (B) digestion of organic molecules
(C) fat synthesis (D) fat emulsification
- In prokaryotic cell
(A) nucleus is developed
(B) membrane bounded organelles are present
(C) double membrane bounded organelles are absent
(D) none of these



8. A typical plant cell contains
(A) cell wall (B) plastids (C) large vacuole (D) all of the above
9. The waste disposal system of cell is formed by
(A) lysosomes (B) peroxysomes (C) mitochondria (D) glyoxysomes
10. In which cell Centriole is absent ?
(A) plant cell (B) Animal cell (C) Both of above (D) None of above

SUBJECTIVE DPP - 4.2

VERY SHORT ANSWER TYPE QUESTIONS

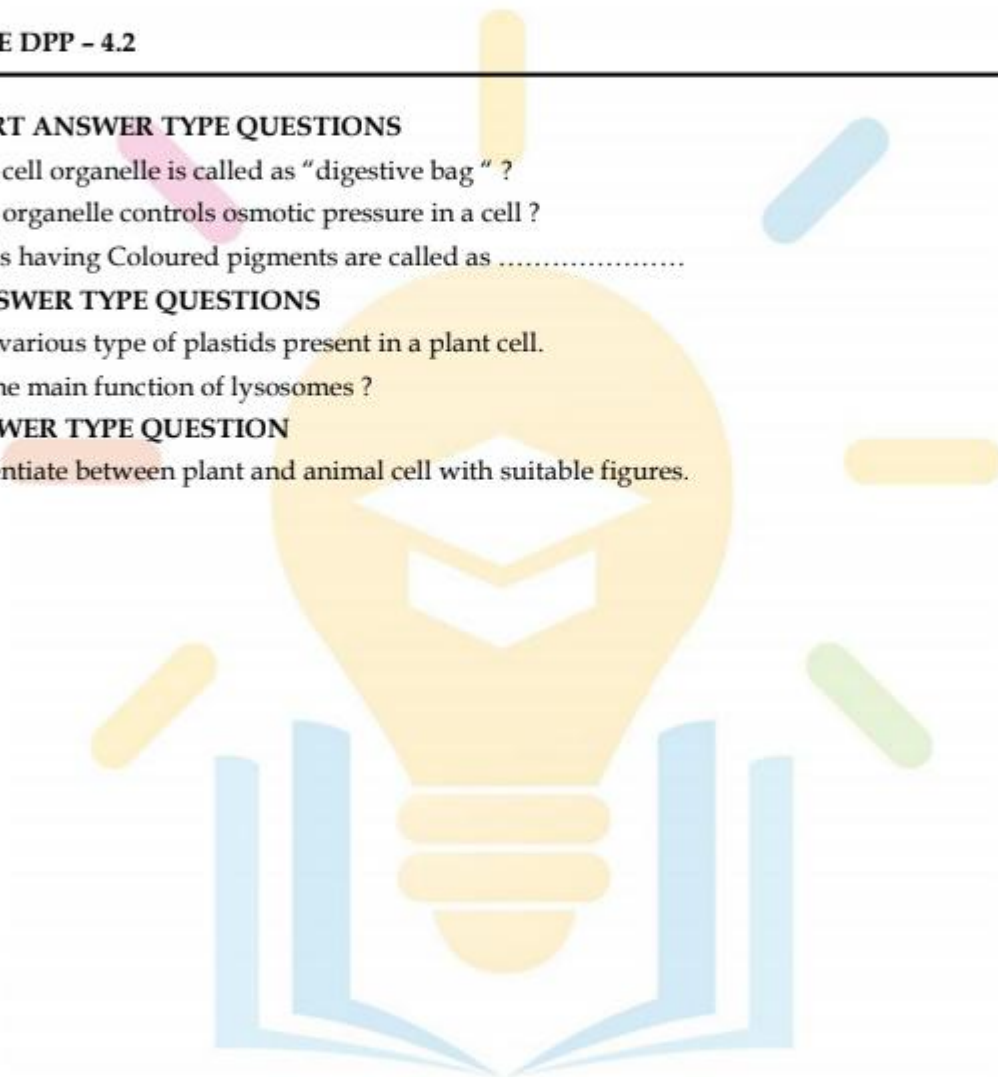
1. Which cell organelle is called as "digestive bag" ?
2. Which organelle controls osmotic pressure in a cell ?
3. Plastids having Coloured pigments are called as

SHORT ANSWER TYPE QUESTIONS

4. Name various type of plastids present in a plant cell.
5. State the main function of lysosomes ?

LONG ANSWER TYPE QUESTION

6. Differentiate between plant and animal cell with suitable figures.



ANSWER KEY

(Objective DPP # 1 .1)

Q	1	2	3	4	5	6	7	8	9	10
A.	C	C	A	B	C	B	C	B	B	D

(Objective DPP # 2 .1)

Q	1	2	3	4	5	6	7	8	9	10
A.	B	B	A	C	A	C	A	B	A	A

(Objective DPP # 3 .1)

Q	1	2	3	4	5	6	7	8	9	10
A.	B	A	C	D	B	A	B	C	C	D

(Objective DPP # 4 .1)

Q	1	2	3	4	5	6	7	8	9	10
A.	B	C	C	C	B	B	C	D	A	A



TISSUE



BL-5

INTRODUCTION

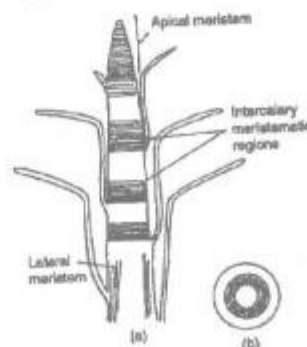
- In unicellular organisms a single cell performs all the vital activities for example, digestion, respiration, excretion etc.
- In case of Multicellular organisms specialized functions are performed by a different groups of cells. As blood flows for transportation of O₂, CO₂, food hormones & waste material, muscle cells are involved in movement etc.
- In plants vascular tissue conduct food & water from one part to another part of the plant. Thus Multicellular organisms possess well-developed division of labour to provide highest possible efficiency or particular function.
- A tissue is defined as a group of cells with similar structure, organized to do a common function.
- Term tissue was coined by **Bichat**.
- As plants are fixed or stationary, most of their tissues are of supportive type. Animals move around in search of food, mate & shelter so they consume more energy as compared to plants.
- Plants have some localized regions with special tissue but there are no such distinct regions in animals. Growth in animals remains uniform. Branch of biology that deals with the study of tissue is called **Histology**.

PLANT TISSUE

Mainly they are of two types : * Meristematic, * Permanent

(a) Meristematic Tissue :

These are simple living tissues having thin walled compactly arranged immature cells which are capable of division and formation of new cells.



(i) Main features of Meristematic tissues are :

(A) $G_1 \rightarrow S \rightarrow G_2 \rightarrow M$ cell cycle is switched on.

- (A). Thin primary cell wall (cellulosic).
- (B). Intercellular spaces are absent (Compact tissue)
- (C). Generally vacuoles are absent, dense cytoplasm & prominent nuclei are present.
- (D). Large number of cell organelles are present.
- (E). Active metabolic state, stored food is absent.
- (F). Actively dividing cells are present in growing regions of plants e.g. root & shoot tips

(ii) Classification on the basis of origin :

(A). primary (Promeristem):

- Derived directly from the Meristems of embryo.
- They consist of cells derived from primary meristem.
- They add to primary growth of plants.

(B). Secondary :

- Formed by permanent tissues.
- These are having cells derived from primary permanent tissue.
- They usually add to the diameter of plants.
- Permanent tissue Dedifferentiation Secondary meristem

(iii) Classification on the basis of location :

- (A) **Apical meristem:** It is present at the growing tips of stems and roots. Cell division in this tissue leads to the elongation of stem & root thus it is involved in primary growth of the plant.
- (B) **Intercalary meristem:** It is present behind the apex. It is the part of apical meristem which is left behind during growth period. These are present at the base of leaf & internode region. These lead to the increase in the length of leaf (Primary) e.g. in grass stem, bamboo stem, mint stem etc..
- (C) **Lateral meristem:** It is also called as secondary meristem. It occurs along the sides of longitudinal axis of the plant. It gives rise to the vascular tissues. Causes growth in girth of stem & root. They are responsible for secondary growth.

EXERCISE

OBJECTIVE DPP - 5.1

1. A group of cells having common origin and performing similar function is called
(A) tissue (B) organ (C) organ system (D) cell aggregate
2. Meristems are cells that
(A) store food (B) help in excretion
(C) provide support (D) divide continuously to produce new cells
3. Plant length is increased by the activity of
(A) apical meristem (B) lateral meristem (C) cambium (D) all of the above
4. In plants, cell division is restricted to
(A) Meristematic cells (B) permanent cells (C) xylem (D) phloem
5. In grasses the length of increases by the activity of
(A) apical meristem (B) intercalary meristem (C) lateral meristem (D) secondary meristem
6. Special feature of dividing cells is
(A) large lacuna (B) thick cell walls
(C) dense cytoplasm devoid of lacuna (D) large intercellular spaces
7. Totipotency is present in
(A) meristem (B) cambium (C) phloem (D) cork
8. Which of the following is a feature of Meristematic tissues ?
(A) Thin cell wall
(B) Compact tissue
(C) Large no. of cell organelles are present in the cells of tissues.
(D) All of the above
9. Which of the following plant tissue is formed by permanent tissue ?
(A) primary tissue (B) Secondary tissue (C) Both of above (D) None of above
10. Which of the following plant tissues causes growth in girth of stem and root ?
(A) Apical meristem (B) Intercalary meristem
(C) Lateral meristem (D) None of the above

SUBJECTIVE DPP - 5.2

VERY SHORT ANSWER TYPE QUESTIONS

1. The tissues derived directly from the meristem of embryo is called as
2. A group of cells with similar structure, organized to do a common function is called as.
3. Which plant tissue remains in active metabolic state always ?

SHORT ANSWER TYPE QUESTIONS

4. Define tissue.
5. What do you mean by division of labour ?

LONG ANSWER TYPE QUESTION

6. What is tissue? Explain Meristematic plant tissue.



TISSUE



BL -6

PERMANENT TISSUE

- The permanent tissues are composed of those cells which have lost their capability to divide. They have definite shape, size and thickness. The permanent tissue may be dead or living.
- The division & differentiation of the cells of Meristematic tissues give rise to permanent tissues. In cell differentiation, developing tissue and organs change from simple to more complex forms to become specialized for specific functions. The cells of permanent tissue lose the capacity to divide and attain a permanent shape, size and function.

(a) **Depending Upon the structure and composition, The permanent tissues are classified into two types :**

(i) **Simple permanent tissues :** These are made up of same type of cells which are similar structurally and functionally. They include two types of tissue :

(A) **Protective Tissues :** these tissues are primarily protective in function. They consist of :

- **Epidermis :** Epidermis forms one cell thick outermost layer of various body organs of plants such as leaves, flowers, stems and roots. Epidermis is covered outside by cuticle. Cuticle is a water proof layer of waxy substance called as cutin which is secreted by the epidermal cells. Cuticle is very thick in xerophytes. Cells of epidermis of leaves are not continuous at some places due to the presence of small pores called as stomata. Each stomata is guarded by a pair of bean shaped cells called as guard cells. These are the only epidermal cells which possess chloroplasts, the rest being colorless.

• **Functions :**

- (i) The main function of epidermis is to protect the plant from desiccation and infection.
- (ii) Cuticle of epidermis cuts the rate of transpiration and evaporation of water and prevents wilting.
- (iii) Stomata in epidermis allow gaseous exchange to occur during photosynthesis and respiration.
- (iv) Stomata also help in transpiration.

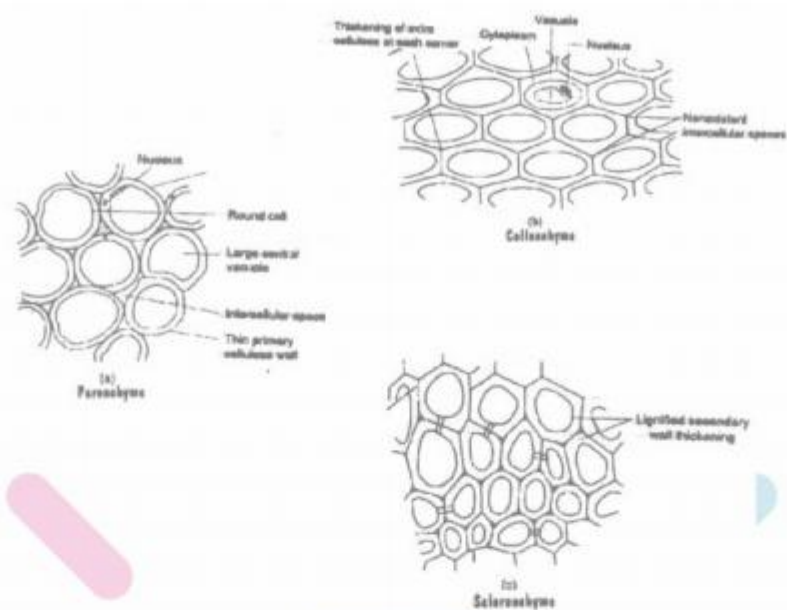
- **Cork or phellem :** in older roots and stems, tissues at the periphery become cork cells or phellem cells. Cork is made up of dead cells with thick walls and do not have any intercellular spaces. The cell walls in cork deposit waxy substance called as suberin. The cells of cork become impermeable to water and gases due to the deposition of suberin. The cork cells are without any protoplasm but are filled with resins or tannins.

• **Functions :**

- (i) Cork is protective in function. Cork cells prevent desiccation, infection and mechanical injury.
- (ii) Imperviousness, lightness, toughness, compressibility and elasticity make the cork commercially valuable.
- (iii) Cork is used for insulation, as shock absorber in linoleum.
- (iv) Cork is used in the making of a variety of sport goods such as cricket balls,

table tennis, shuttlecocks, wooden paddles etc.

Supporting tissue : These are supportive in function and of three types



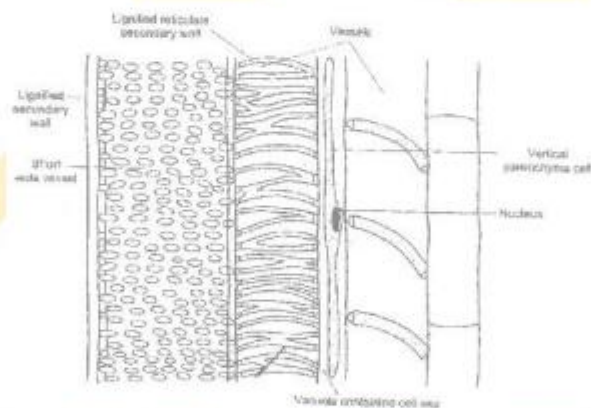
- **Parenchyma:** it is the fundamental tissue.
- Tissue first time evolved in bryophyte.
- Thin walled cells, oval or spherical in structure.
- Cell wall mainly composed of cellulose & pectin.
- Large central vacuole for food & water storage.
- Primary function is food storage.
- Some parenchyma involved in excretory substance storage are so called as idioblast, storing such as resin, tannin, gums & oils. In typical parenchyma chlorophyll is absent.
- Chloroplast containing parenchyma tissue are chlorenchyma which perform photosynthesis e.g. mesophyll of leaves.
- In hydrophytic plants aerenchyma (A type of parenchyma containing air spaces) provides buoyancy.
- Parenchyma provides turgidity to cells.
- Collenchyma : it is the living mechanical tissue.
- Elongated cells with thick corners.
- Localized cellulose & pectin thickening.
- Provides flexibility to plant parts & easy bending of various parts of plant.
- Present only in herbaceous dicot stem.
- Present at thin margin of leaves.
- Few chloroplasts may be present.
- If gives mechanical strength & elasticity to the growing stems.
- Sclerenchyma : (Scleras-hard)
- Strengthening tissue.
- Composed of extremely thick walled cells with little or no protoplasm.
- Cells are dead & possess very thick lignified walls.
- Lignin is water proof material.
- Inter cellular spaces are absent.

- Cells of Sclerenchyma are of two types :
- **Sclereids:** These are also called grit cells or stone cells. These are small cells, where lumen is so small due to higher thickening of cell wall, as present in drup fruit (Mango, coconut walnut) in legume seeds (Macroscleireid)
- **Fibers :** They are very long, narrow, thick, lignified cells. Lumen is large as compared to sclereids. Generally 1-3 mm. long. In the thick walls of both the fibres and sclereids are present thin areas called as pits.
- Sclerenchyma fibres are used in the manufacture of ropes, mats & certain textile fibres.
- Jute & coir are obtained from the thick bundles of fibres.

(ii) **Complex permanent tissue :** it consists of more than one type of cells which work together as a unit.

- It helps in transportation of organic materials, water & minerals.
- It is also known as conducting or vascular tissue.
- Xylem & phloem together form vascular bundles.

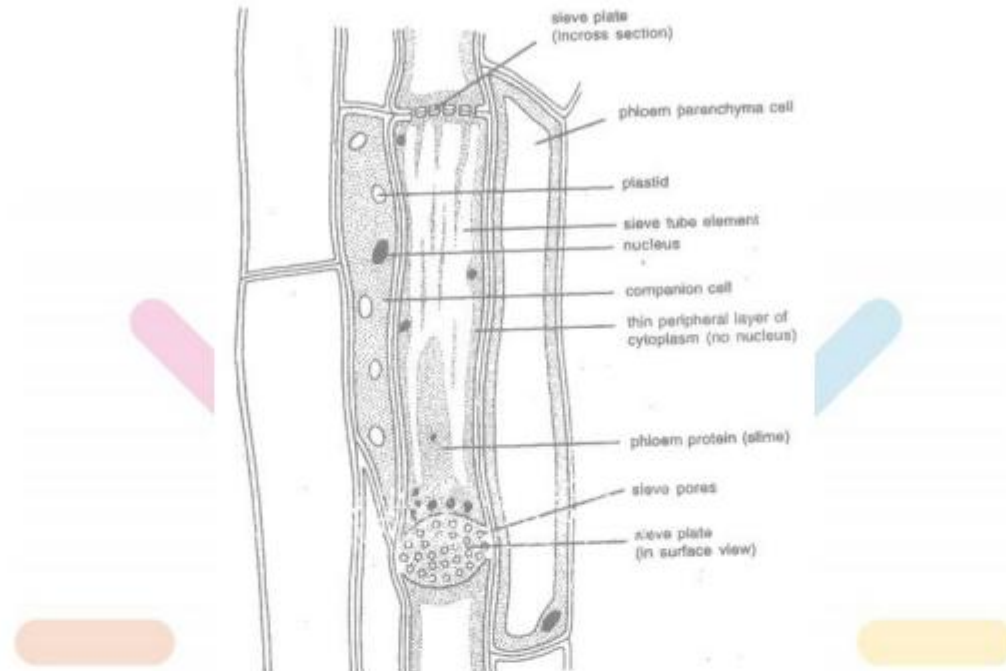
(A) **Xylem :** Also known as wood and is a vascular and mechanical tissue. Thick walled cells are found in the form of tubular passages.



- **Xylem consists of four types of cells called as elements :**
- **Tracheids :** They are elongated angular dead cells (Primitive elements) mainly involved in conduction of water & minerals in gymnosperms.
- **Vessels:** they are advanced element (Generally found in angiosperms). Vessels are cylindrical tube like structures placed one above the other end to end which form a continuous channel for efficient conduction of water.
- **Xylem parenchyma :** they are small & thick walled parenchymatous cells
- Subjected for storage of starch (food).
- **Xylem Sclerenchyma :** They are non living fibres with thick walls & narrow cavities provide mechanical support.
- **Except xylem parenchyma all other xylem elements are dead.**
- **Hadrome :** Tracheids & vessels are collectively called hadrome, as main

- Conducting elements in xylem.
- The annual rings present in the trunk of a tree are xylem rings. By Counting the number of annual rings we can determine the age of a tree.

(B) Phloem : They also consist of both parenchymatous & sclerenchymatous cells.



- **Phloem consists of four types of element :**
- **Sieve tubes :** Sieve tubes are slender tube like structures made up of elongated, thin walled cells placed end to end. The end walls of sieve tube cells are perforated by numerous pores are called as sieve plates. Nucleus of sieve cell degenerates at maturity, however. Cytoplasm persists, because of protoplasmic continuation of sieve tube with companion cell through plasmodesmata. Sieve cells possess slime protein or protein which is concerned with growth and repair of sieve cells.
- **Companion cells :** Companion cells have dense cytoplasm and prominent nuclei.
- **Sieve cells & companion cells** are so called sister cells because they originate from single mother cell.
- **Phloem fibre :** They give mechanical support to sieve tubes
- **Phloem parenchyma :** They store food & help in radial conduction of food.
- **Leptome :** main part of phloem involved in conduction of food, which is sieve tube.
- In xylem only unidirectional movement is possible while in phloem bidirectional movement can occur.
- In phloem except phloem Sclerenchyma all elements are living.

EXERCISE

OBJECTIVE DPP - 6.1

1. A permanent plant tissue consisting of thin walled living cells is
(A) parenchyma (B) collenchyma (C) Sclerenchyma (D) xylem
2. A permanent plant tissue made up of living having thickening at the comers is
A) Sclerenchyma (B) collenchyma (C) parenchyma (D) phloem
3. The main function of Sclerenchyma is to help in the
(A) conduction of food (B) synthesis of food (C) exchange of gases (D) mechanical support
4. The wall of cork cells are thickened by the deposition of
(A) cutin (B) suberin (C) lignin (D) pectin
5. The wax like substance present in the cell wall of onion skin is
(A) pectin (B) lignin (C) cellulose (D) suberin
6. The outer wall of epidermis in stems and leaves has a waxy covering made up of
(A) lignin (B) suberin (C) pectin (D) cutin
7. Collenchyma differs from Sclerenchyma in
(A) retaining cytoplasm at maturity (B) having thick walls
(C) having a wide lumen (D) being Meristematic
8. Lignified elongated bead cells are
(A) parenchyma (B) collenchyma (C) sclerenchyma (D) Epidermis
9. Which of the following plant tissue lacks protoplasm at matunty ?
(A) Sclerenchyma (B) Collenchyma (C) parenchyma (D) Epidermis
10. In plants phloem tissues perform the function of
(A) conduction of water (B) conduction of food (C) photosynthesis (D) mechanical support

SUBJECTIVE DPP - 6.2

VERY SHORT ANSWER TYPE QUESTIONS

1. sieve tubes and companion cells are found in..... tissue (xylem/phloem/collenchyma)
2. Long, narrow, dead cells having a thick deposition of lignin in the cell wall are called Cells.
(parenchyma/ cambium / sclerenchyma)
3. Which tissue is responsible for transport of water in plants ?

SHORT ANSWER TYPE QUESTIONS

4. Name the different elements of xylem and phloem.
5. In hydrophytes xylem is less developed, why ?

LONG ANSWER TYPE QUESTION

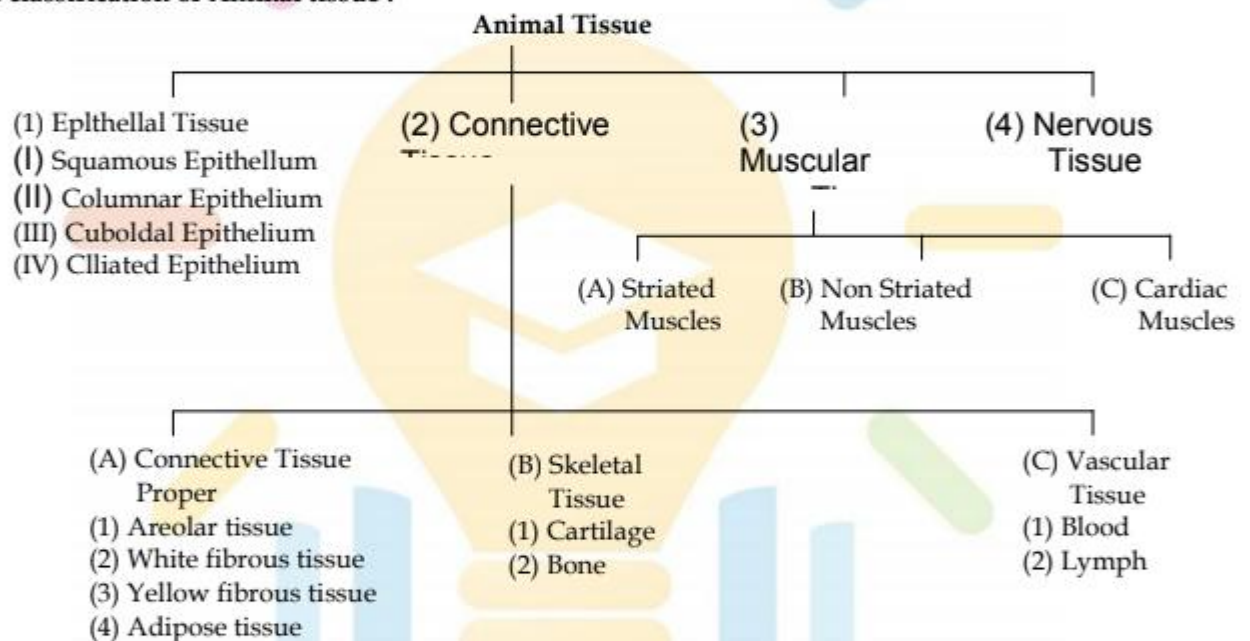
6. Mention the role of parenchyma, collenchyma & Sclerenchyma.

TISSUE

BL - 7

ANIMAL TISSUE

Outline classification of Animal tissue :



- The study of microscopic structure of tissues is called as Histology. Cells of a tissue are often held together by cell junctions.

(a) Epithelial Tissue :

[Epi means above & thelial means to grow]

- Always grows on some other types of tissue.
- Cells of epithelium are set very close to each other and the tissue rests on a non- cellular basement membrane.
- Consists of single layer of cells.
- Blood vessels are absent & non nervous in nature.
- It covers all the organs & lines the cavities of hollow organs like stomach.
- It is primarily protective in function.
- Epithelial tissues are classified as :

- (i) Squamous epithelium: Also called pavement epithelium.
 - Cells arranged end to end like tiles on a floor.
 - Cells are polygonal in surface view.
 - It forms the delicate lining of cavities (mouth, oesophagus, nose, pericardium, alveoli etc.) blood vessels and covering of the tongue and skin.
- Epithelial cells are arranged in many layers (stratum) to prevent wear and tear in skin. This pattern is stratified squamous epithelium.
- (ii) Cubical epithelium : They are cube like cells that fit closely, cells look like squares in section, but free surface appears hexagonal.
 - It is found in kidney tubules, thyroid vesicles & in glands (salivary glands, sweat glands).
 - It forms germinal epithelium of gonads (testes & ovaries)
 - It involves in absorption, excretion & secretion. It also provides mechanical support.
- (iii) Columnar epithelium : Columnar means "pillar-like" epithelium. It forms lining of stomach, Small intestine & colon, forming mucous membranes. Border of microvilli is present at the free surface end of each cell which increases absorption efficiency in small intestine.
- (iv) Ciliated epithelium :
 - Cells may be cubical or columnar.
 - On it's free surface are present protoplasmic outgrowths called cilia.
 - It helps in the movement of ova in the fallopian tube.

(b) Connective Tissue :

The cells of the connective tissue are widely spaced and embedded in an intercellular matrix.

- The nature of matrix decides the function of tissue.
- White & yellow fibres are present in the matrix.
- Their basic function is to provide support to different organs & keeping them in place.

(i) Fluid or vascular tissue :

(A) Blood & lymph : Blood is a connective tissue, fluid matrix of blood is plasma having wandering or floating cells, called corpuscles, blood helps in the transportation of various materials such as nutritive substances, gases, excretory products, hormones etc.

Plasma	:	form 55% part of blood.
Constitution		
90-91%	:	water
7%	:	protein (Albumin, fibrinogen, globulin)
0.9%	:	inorganic salt etc.

- Corpuscles: Forms 45% part of blood.
 - RBC's they are also called as erythrocytes, containing red Coloured respiratory pigment called hemoglobin that helps in transportation of oxygen.
 - WBC's (Leucocytes: They are also called as" Soldiers of the body". They are irregular, amoeboid, phagocytic cells that protect our body by engulfing bacterial & other foreign particles. They are of five types: Monocytes, Lymphocytes, Basophiles, Neutrophils, Eosinophils.
 - Blood platelets or thrombocytes: They are spindle shaped cells which are involved in clotting of blood.
- (ii) Skeletal tissue : It is hard connective tissue that forms supportive frame work of the body. It

is of two types :

(A) Bone :Matrix of bone is very hard because of salts such as calcium phosphate, CaCO_3 (60-70%) etc. and a protein ossein. Bone cells (osteoblasts) are embedded in this hard matrix. Matrix is deposited in the form of concentric layers of lamellae formed round a central canal (Haversian canal), the bone cells occupy small spaces between the concentric layers of matrix. The long bones are usually hollow containing cavity called as marrow cavity. It is full bone marrow.

(B) Cartilage : This tissue is elastic, less harder as compared to bone. Elasticity is due the presence of chondrin (protein). Cells are called as chondroblast, which are widely spaced and matrix is reinforced by fibres. It occurs at joint of bones, in the nose, ear, trachea & larynx. It provides flexibility and great tensile strength.

(C) Connective tissue proper : it is the most abundant type of connective tissue. It is further divided into following types:

(D) Areolar tissue : It is the most distributed connective tissue in the body. This tissue fills spaces inside organs & is found between the skin & muscles, around blood vessels, nerves & in the bone marrow.

- There are two types of fibres —
 - Inelastic white
 - Elastic yellow fibres

(A) Adipose tissue : These are oval & round cells, filled with fat globules. The cells are called as adipocytes. It found in subcutaneous layer below the skin, around the heart, brain & below the eyeballs. It acts as an insulator & prevents loss of heat from the body.

(B) White fibrous connective tissue : They are very little matrix containing abundant white fibres forming layers. Bundles of this tissue are called as tendons, which attaches muscles to the bones.

(C) Yellow fibrous connective tissue : They are very elastic due to the presence of a network of yellow fibres in it's matrix called as ligament which attaches bone to bone.

EXERCISE

OBJECTIVE DPP - 7.1

- The entire body surface and cavities inside the body are lined by
(A) muscle tissue (B) epithelial tissue (C) connective tissue (D) nervous tissue
- Which one of the following is a fluid connective tissue ?
(A) Areolar tissue (B) cartilage (C) Blood (D) Ligaments
- The tissue that attaches muscles to the bones is
(A) cartilage (B) tendon (C) ligament (D) blood
- The tissue that joins one bone to the other is
(A) ligament (B) tendon (C) blood (D)) cartilage
- Areolar tissue is a
(A) nervous tissue (B) muscular tissue (C) connective tissue (D) epithelial tissue
- Tendon is a structure which connects
(A) a bone with another bone (B) a muscle with a bone
(C) a never with a muscle (D) a muscle with a muscle

-
7. Fluid part of blood after removal of corpuscles is
(A) plasma (B) lymph (C) serum (D) vaccine
8. Which of the following structures joins skeletal muscle to bone ?
(A) Ligament (B) Tendon (C) Blood (D) Bone
9. Yellow muscle fibers are also called as
(A) bone (B) muscle (C) ligament (D) none of these
10. Ligament joins
(A) bone the muscle (B) muscle to muscle (C) bone to bone (D) none of these

VERY SHORT ANSWER TYPE QUESTIONS

1. The special property of muscle fibres to contract forcefully and return to relaxed state is called (Excitability/contractility/flexibility)
2. A branch of science dealing with the study of bones is called
(Ornithology/physiology /osteology)
3. The fluid matrix of blood is called.....(plasma/lymph/serum)

SHORT ANSWER TYPE QUESTIONS

4. What do you mean by division of labour?
5. Write the composition of mammalian blood.

LONG ANSWER TYPE QUESTION

6. Give summarized classification of animal-tissue

TISSUE

BL-8

MUSCULAR TISSUE

Movements are brought about in our body with the help of muscular tissues.

(a) **Features :**

- They are long fibre-like cells called muscle fibres.
- They are capable of contraction or relaxation

(b) **Types :**

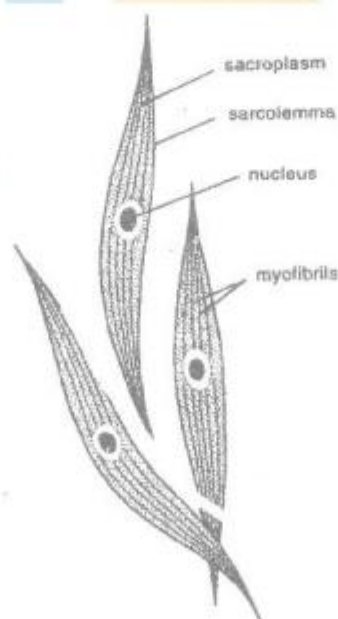
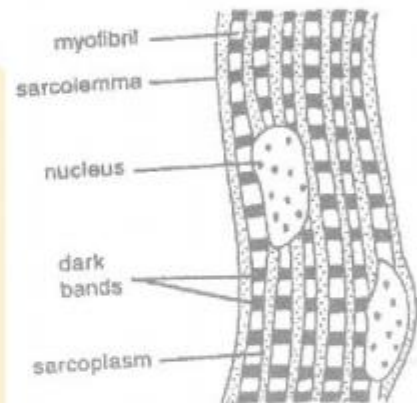
It is of three types :

- (i) **striated muscles :** They are also called as voluntary muscles because these are under the control of one's will. Muscle fibres or cells are multinucleated and unbranched.

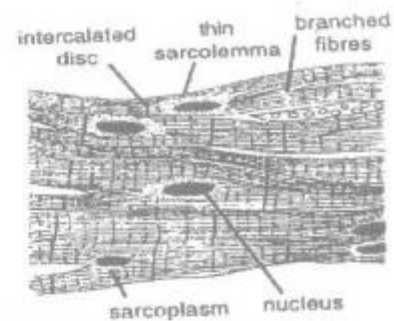
Each fibre enclosed by thin membrane which is called as sarcolemma.

Cytoplasm is called as sarcoplasm. These muscles get tired & need rest.

- (ii) **Non striated muscles:** They are involuntary muscles also called as smooth muscles. These muscle fibres are uninucleated & spindle shaped. They are not enclosed by membrane but many fibres are joined together in bundles. Such muscles are found in the walls of stomach, intestine, urinary bladder, bronchi, iris of eye etc. peristaltic movements in alimentary canal are brought about by smooth muscles.



(iii) cardiac muscle fibres : They are also involuntary muscles. Only found in the walls of heart. Their structure is in between the striated & non-striated muscles. They are uninucleated & branched. Branches are united by intercalated disc. In these muscles rhythmic contraction & relaxation occurs throughout the life.

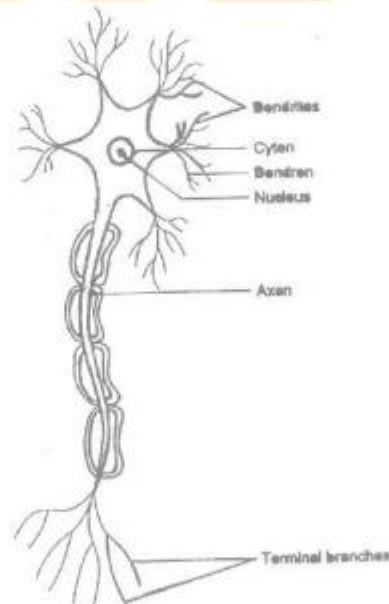


NERVOUS TISSUE

- They are highly specialized tissue due to which the animals are able to perceive and respond to the stimuli.
- Their functional unit is called as nerve cell or neuron.
- Cell body is cyton covered by plasma membrane.
- Short, hair like extensions arising from cyton are dendrons which are further subdivide into dendrites.
- Axon is long, tail like cylindrical process with fine branches at the end. Axon is covered by a sheath.
- Axon of one neuron is very closely placed to the dendrons of another neuron to carry impulses from one to another neuron in the form of electrochemical waves. This close proximity is called as synapse

(a) Types :

Nerve fibres are of two types :



(i) **Medullated fibres**

(ii) **Non-medullated fibres**

(b) Functions :

- They control all the body activities
 - They co-ordinate between various parts during any body function.
- Spinal cord & brain are made up of nervous tissue.

EXERCISE

OBJECTIVE DPP - 8.1

- Contraction and relaxation are unique features of
(A) epithelial tissue (B) connective tissue (C) muscle tissue (D) nervous tissue
- The tissue which is under the control of animal's will is
(A) cardiac muscle (B) striated muscle (C) non-striated muscle (D) cartilage
- The muscle which work throughout life without undergoing fatigue is
(A) striated muscle (B) non-striated muscle (C) cardiac muscle (D) all of the above
- Which of the following is a voluntary muscle ?
(A) striated muscle (B) Unstriated muscle (C) cardiac muscle (D) (A) and(B)
- Wall of urinary bladder consists of
(A) striated muscle (B) Unstriated muscle (C) both of above (D) none of these
- Intercalated discs are present in
(A) striated muscle (B) Unstriated muscle (C) cardiac muscle (D) all of the above
- The function unit of nervous tissue is called as
(A) cyton (B) synapse (C) neuron (D) axon
- Which type of tissue forms spinal cord and brain ?
(A) muscle tissue (B) Nervous tissue (C) epithelial tissue (D) Epidermis
- Involuntary tissue forms wall of which of the following organ ?
(A) intestine (B) stomach (C) bronchi (D) all of the above
- Movements in body are brought about by
(A) muscle tissue (B) epithelial tissue
(C) Bones (D) tendons and ligaments

SUBJECTIVE DPP - 8.2

VERY SHORT ANSWER TYPE QUESTIONS

- Spindle-shaped, non-striated, involuntary muscle fibres present in hollow internal organs like urinary bladder are called (smooth muscle fibres /striated muscle fibres/cardiac muscle fibres)
- The brain and the spinal cord are made up of (nephrons/erythrocytes /neurons)
- The small, branched processes of a nerve cell are called.....(dendrites/axons/neurons)

SHORT ANSWER TYPE QUESTIONS

- What is the function of nervous tissue ?
- State the main features of muscular tissue.

LONG ANSWER TYPE QUESTION

- Describe the structure of neuron with labeled diagram.

ANSWER KEY

(Objective DPP # 5 .1)

Q	1	2	3	4	5	6	7	8	9	10
A.	A	D	A	A	B	C	A	D	B	C

(Objective DPP # 6 .1)

Q	1	2	3	4	5	6	7	8	9	10
A.	A	B	D	B	B	D	A	C	A	B

(Objective DPP # 7 .1)

Q	1	2	3	4	5	6	7	8	9	10
A.	B	C	B	A	C	B	A	B	C	C

(Objective DPP # 8 .1)

Q	1	2	3	4	5	6	7	8	9	10
A.	C	B	C	A	B	C	C	B	D	A

➤➤➤ DIVERSITY OF LIVING ORGANISMA ◀◀◀

BL - 9

DIVERSITY AND CLASSIFICATION

Diversity means = variety. Different places on the earth have their own typical kinds of living beings. This gives rise to the need of classification. So "Diversity is the need of classification".

- Classification is the theory and practice of classifying organisms. It is the systematic arrangement of organisms on the basis of their relatedness.
- Classification is the arrangement of organisms into sets or groups according to the similarities and dissimilarities present between them.

(a) Advantages / Significance of Classification :

- It establishes hierarchy of groups of organisms on the basis of their common features.
- It makes the systematic study easier.
- It is essential to understand the interrelationship amongst different groups of organisms.
- It serves as a base for the development of these biological sciences as well as different fields of applied biology like public health, environment etc.

(b) Taxonomic Hierarchy :

It is the framework by which taxonomic groups are arranged in definite order from higher to lower categories. The hierarchical order of classifying organisms is :

Kingdom → phylum → class → order → family → genus → species

(i) Taxon : it refers to any rank or category in the hierarchical order of classification. E.g. kingdom, phylum etc. the highest taxon is kingdom while the lowest taxon is species.

(ii) Species : These are the groups of organisms having similar morphological characters which can freely interbreed & produce their own kind. It is the basic unit of classification.

(c) Nomenclature :

It is the system of naming an individual. Nomenclature is done on the basis of a set of rules stated in the ICN i.e. international Code of Nomenclature.

(i) Binomial nomenclature : It is a system of naming the organisms in such a way that each of their names contain two components first is genus and the second one is species. E.g. scientific name of human is *Homo sapiens*. Scientific name of crow is *Corvus splendens*. *Homo* and *Corvus* are the genus while *sapiens* and *splendens* are the names of species. This system was introduced by Carolus Linnaeus in his book *Systema Naturae*. Who is also called Father of Taxonomy.

(ii) Certain conventions are followed while writing the scientific names

- The name of the genus begins with a capital letter.
- The name of the species begins with a small letter.
- When printed, the scientific name is given in italics.

- When written by hand, the genus name and the species name have to be underlined separately.

(d) System of Classification :

(i) **Artificial system:** It was based on some superficial similarities. i.e. only one or few characters were taken .e.g. on the basis of habitat and ability to fly.

(ii) **Natural system:** It was based on natural affinity i.e. more than one natural characters were used.

(iii) **Phylogenetic system:** It was based on evolutionary sequence as well as genetic relationship amongst the organisms.

Classification of Organisms :

(iv) **Two kingdom system:** It was given by Carolus Linnaeus in 1758. organisms were divided into plant kingdom and animal kingdom. Fungi, Bacteria and Euglena could not find an appropriate position.

(v) **Three kingdom system:** It was given by Earnst Haeckel. In this kingdom protista was also included along with plant kingdom and animal kingdom.

(vi) **Four kingdom system:** It was given by Copeland. Kingdom Monera was also included in this system of classification.

(vii) **Five kingdom system:** It was given by Robert Whittaker. According to him organisms were divided into five kingdoms.

(A) Kingdom Monera : Unicellular, prokaryotic, microscopic, most ancient, can live in deep oceans, hot spring, deserts, high salt concentration etc. they include bacteria, filamentous and photosynthetic blue green algae etc.

(B) Kingdom Protista: Unicellular, colonial, eukaryotic. They include photosynthetic algae, decomposers (slime moulds) and protozoa (predators) etc.

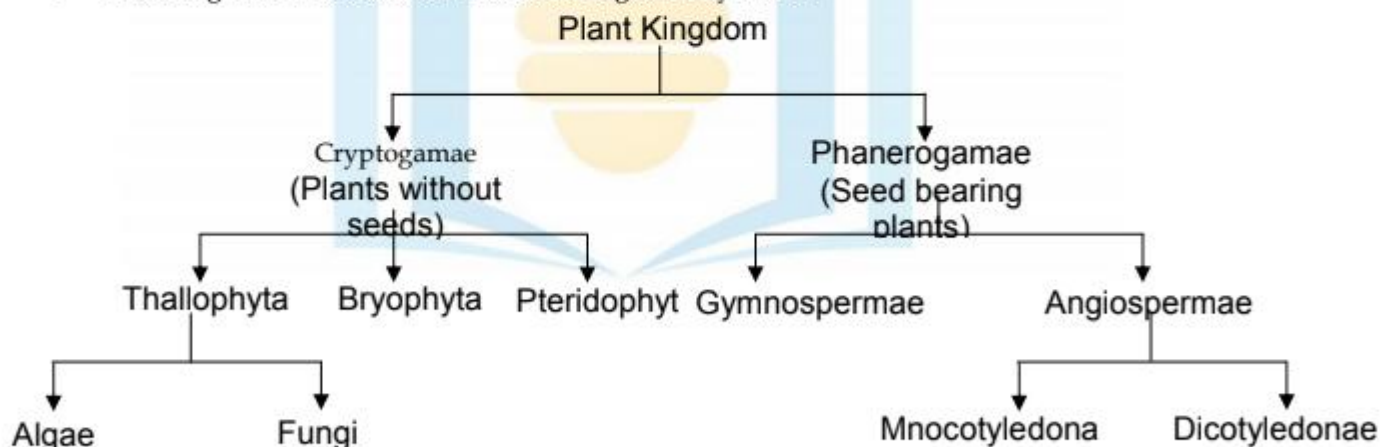
(C) Kingdom Fungi: Unicellular or multicellular eukaryotic organisms, they are heterotrophic, parasitic or saprotrophic.

(D) Kingdom Plantae: They are multicellular, eukaryotic, autotrophic (photosynthetic), some are heterotrophic and parasitic. They include photosynthetic algae, green plants etc.

(E) Kingdom Animal: Multicellular, eukaryotic, heterotrophic.

BASIS OF CLASSIFICATION

- Complexity of structure
- Mode of nutrition
- Level of organization
- Plant kingdom was divided in two sub kingdoms by Eichler



(b). Sub kingdom Cryptogamae : (Cryptos = hidden gamous = marriage) :

- These are also called as lower plants, flowerless or seedless plants.
- Their reproductive organs are hidden till they reproduce.

(i) Division Thallophyta :

- Thallus : Undifferentiated plant body i.e. absence of root, stem & leaves.
- There is no vascular system.
- Reproductive organ are single-celled and there is no embryo formation after fertilization.
- Dominant gametophyte.
- Three classes of thallophyta are :

(A) Class Algae :

Characters :

- These are aquatic or terrestrial, fresh water or marine. Autotrophic, photosynthetic containing various pigments like chlorophyll, carotenoids, xanthophylls etc.
- Unicellular, colonial, filamentous.
- Cell wall of cellulose, e.g. blue green algae (Nostoc) , Green algae (Ulothrix, Spirogyra) Brown algae, red algae etc.



Spirogyra

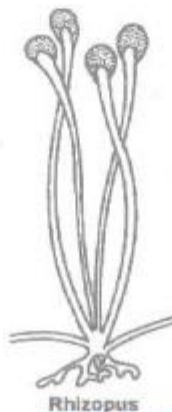
(B) Class Fungi :

Characters :

- These are heterotrophic.
- They lack chlorophyll but have cell wall of chitin (fungus cellulose)..
- They can be parasitic or saprotrophic
- Their body is filamentous called as mycelium.
- Reserve food material consists of glycogen. E.g. moulds (Rhizopus) , Yeasts (Saccharomyces) Mushroom, (Agaricus)..



Yeast



Rhizopus



Mushroom

(C) **Lichen :**

Characters:

- It is symbiotic relationship between algae and fungi.
- Algal part is Phycobiont and fungal part is mycobiont.
- They grow on rocks, tree trunks, grounds etc. e.g. parmellis, Alectoria etc.



Lichen

(ii) Division Bryophyta :

- Bryophytes are called terrestrial amphibians (amphibians of plant kingdom) because they require moist soil surface for swimming of their sperm & supply of water to all parts.
- They are the first amongst land plants which occur in damp & shady habitat
- Plant body is of primitive form i.e. differentiated only in stem & leaves.
- Vascular tissue & mechanical tissue are absent in them.
- Male gamete is flagellated.
- Sex organs are jacketed & multicellular.
- Fertilization produces embryo.
- They show heteromorphic type of alternation in generation. E.g. liverworts (Riccia, Marchantia), hornworts (Anthoceros) and mosses (Funaria).



Liverwort

(iii) Division Pteridophyta :

Characters:

- They are seedless vascular plants, primitive tracheophytes or vascular cryptogams
- Plant body is differentiated into true stem, leaves & roots.
- Vascular tissue are present.
- Sperms are flagellated.
- Embryo stage is present.
- Gametophytes are small, exosporic or endosporic.
- Sex organs are jacketed & multicellular, e.g. ferns (Dryopteris, Pteris), club moss (Lycopodium), Horsetail (Equisetum).



Equisetum (Horsetail)

(b). Sub kingdom: Phanerogamae: (phaneros = visible: gamous = marriage.)

- These are higher plants having flowers and seeds both.
- Body differentiated into true stem, leaves and root.
- Vascular system is well developed.
- Sex organs are multicellular.
- Embryo develops from fertilized egg.
- It is divided into two divisions :

(i) Division Gymnospermae :



Cycas

Characters:

- Seeds are not enclosed in fruits. These are naked seeded.
- They have well developed vascular system but xylem lacks vessels and phloem lack companion cells.
- They occupy an intermediate position between the pteridophytes and the angiosperms.
- Plants are commonly tall trees or shrubs.
- The flowers are represented by unisexual cones, often both being present on the same plant. E.g. *Cycas*, *pinus* (commonly known as pine)

(ii) Division : Angiospermae :

Characters:

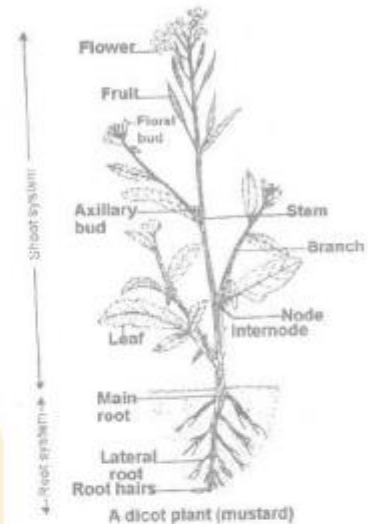
- These are seed bearing.
- These are represented by trees, herbs, shrubs.
- Body well differentiated into root, system.
- Seeds remain enclosed in ovary.
- It is divided into two classes on the basis of number of cotyledons.

(A) Class : Dicotyledonae :

- Their seeds have 2 cotyledons in the embryo.
- Leaves are dorsiventral and show reticulate venation.
- Tap root is present. E.g. neem, Peepal,
- Mango, pea, Mustard.

(B) Class : Monocotyledonae

- Their seeds have one cotyledon in embryo.
- Leaves are isobilateral, with parallel venation.
- Fibrous root system is present, e.g. wheat, Maize, Onion.



EXERCISE

OBJECTIVE DPP - 9.1

- Classification reflecting the evolutionary interrelationships of organisms is called
(A) Phylogenetic classification (B) artificial classification
(C) Natural classification (D) numerical classification
- Principles and rules of classification are studied under
(A) systematics (B) natural classification (C) nomenclature (D) taxonomy
- Two kingdom classification was given by
(A) Linnaeus (B) Haeckel (C) Copeland (D) Whittaker
- Three kingdom classification was proposed by
(A) Linnaeus (B) Haeckel (C) Whittaker (D) Lamarck

5. Five kingdom Whittaker was proposed by
(A) Linnaeus (B) Whittaker (C) John Ray (D) Lamarck
6. Thallophyta includes
(A) fungi and bacteria (B) algae, fungi, animals and lichens
(C) Algae, fungi and lichens (D) algae and fungi
7. Flowering plants are included under
(A) cryptogams (B) phanerogams (C) bryophytes (D) pteridophytes
8. Which of the following has an embryo but lacks vascular tissue?
(A) Bryophyta (B) Pteridophyta
(C) Gymnosperms (D) angiosperms
9. Algae are characterized by (or) algae differ from bryophytes in
(A) aquatic habit (B) Thalloid plant body
(C) Pyrenoids (D) unicelled sex organs
10. The most primitive vascular plants are -
(A) bryophytes (B) pteridophytes
(C) Gymnosperms (D) angiosperms

SUBJECTIVE DPP - 9.2

VERY SHORT ANSWER TYPE QUESTIONS

1. What is classification?
2. What is the lowest category of classification?
3. What is meant by nomenclature?
4. Name the scientist who proposed the binomial system.
5. Define taxon.

SHORT ANSWER TYPE QUESTIONS

6. What are thallophytes?
7. What are phanerogams?
8. What are the advantages of classification organisms?

LONG ANSWER TYPE QUESTION

9. Draw an outline of Eichler classification.

DIVERSITY OF LIVING ORGANISMS

BL-10

ANIMAL KINGDOM

(a) Basis of Classification :

- Organization and differentiation of cells to form tissues and organs.
- Body symmetry.
- Formation to body cavities and blood vascular system.
- Features of embryonic development.

ON THE ABOVE BASIS ANIMAL KINGDOM IS DIVIDED INTO 11 PHyla

(a) Phylum Protozoa :

Characters:

- They are unicellular, eukaryotes
- These are the simplest & the most primitive animals. their body organization is of "Protoplasmic Level".
- They are of different shapes i.g. irregular elongated or rounded.
- They have different types of locomotory organs like cilia, flagella, pseudopodia (false feet)etc.
- Nutrition is of different types like holozoic, holophytic, mixotrophic.
- Digestion is intracellular & it : takes place in food vacuole.
- Excretion & respiration occurs through general body Surface by the process of simple diffusion.
- Reproduction may be sexual or asexual.
- Alternation of generation is found. E.g., Amoeba, Entamoeba, plasmodium, Euglena, Paramecium.

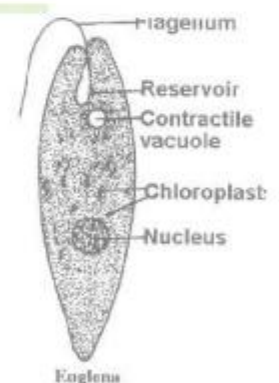
(b) Phylum Porifera :

Characters:

- These are pore bearing organisms i.e. with porous body.
- Also called as sponges.
- Aquatic, mostly marine.



Amoeba



Euglena



Sycon

- These are sessile and sedentary (attached to substratum).
- Occur in different shapes i.e. vase-like, rounded, sac like etc.
- Body perforated by numerous pores called ostia which open into a canal system having canals and chambers lined with coenocytes (flagellated) and have a large size water outlet called oscula.
- Their cavity is called spongocoel.
- Endoskeleton is made of needle like spicules made of calcium carbonate and silica or spongocoel.
- Hermaphrodite, Asexual reproduction by budding. E.g., Sycon, Spongilla, Euplectella.

(c) **Phylum - Coelenterata or Chidaria :**

Characters:

- These are sac like structures. They have a body Cavity called gastrovascular cavity or coelenteron. It has single opening for ingestion and egestion both.
- Aquatic, mostly marine
- Multicellular, diploblastic, radially symmetrical.
- They have special organs called tentacles, chidoblast. Or nematocyst cells. They are specialized for stinging. They paralyse the prey by releasing poison.
- These are polymorphic i.e. they occur in two forms.



- (i) Polyp is asexual, cylindrical, sedentary and diploid.
- (ii) Medusa is sexual, umbrella shaped, free swimming and diploid.
- Asexual reproduction by budding and sexual reproduction by gametes.
- Some of them have exoskeleton of CaCO_3 . they are called Corals, they live in colonies and when they die they form coral reefs, or islands. E.g. hydra, jelly fish.

(d) **Phylum - Ctenophora :**

Characters:

- Body is transparent with radial symmetry.
- They possess comb plates that are ciliated and 8 in no. these help in locomotion. They also possess tentacles.
- Marine, solitary and free swimming. E.g. cestum.

(e) **Phylum - Platyhelminthes : (Platys = Flat; helminth = worm)**

Characters:

- Generally called as flatworms.
- Bilaterally symmetrical, triploblastic, dorsoventrally flattened.
- Acoelomates.
- Their digestive cavity has a single opening with mouth only and anus is absent.
- They possess hooks and suckers.
- They have flame cells or protonephridia for excretion.
- Mode of nutrition is parasitic.
- Reproduction is of both types i.e. asexual and sexual



- These are hermaphrodite. E.g. Planaria, Fasciola (liver fluke)

(f) Phylum - Nematoda (Aschelminthes) :

Characters:

- Also called as roundworms.
- Bilaterally symmetrical, unsegmented triploblastic.
- These are pseudocoelomic.
- Their alimentary canal is tubular having both mouth and anus.
- Most are free living, some live in moist soil, some are fresh water while some are marine.
- Some are parasites on plants & animals.
- They lack circulatory system.
- Reproduction is sexual and sexes are separate. E.g. Ascaris (round worm), filarial worm.

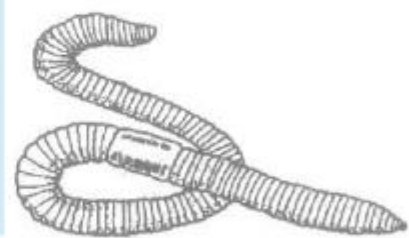


Ascaris

(g) Phylum - Annelida (Annulus = ring ; segments)

Characters:

- Their body is triploblastic, bilaterally symmetrical, soft, elongated, vermiform, cylindrical and dorsoventrally flattened.
- Body is metamerically segmented. Head is formed by joining of some anterior body segments.
- Exoskeleton is absent, body is covered by thin cuticle.
- Eucoelomata i.e. They have true body cavity which first appeared in this phylum.
- Well developed alimentary canal is present.
- They have closed circulatory system.
- Locomotion is with the help of chitinous projections Called chatae (setae).
- Excretion by nephridia.
- Nervous system has dorsal brain.
- Most are aquatic, marine or fresh water, some are terrestrial.
- They reproduce sexually e.g. Earthworm, Leech.

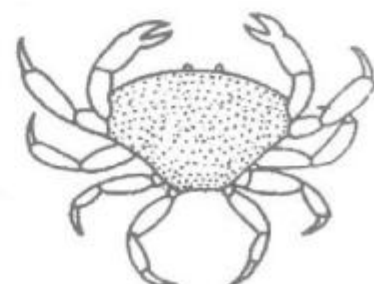


Earthworm

(h) Phylum - Arthropoda (Arthros → jointed , poda = legs)

Characters:

- These are the organisms with jointed appendages.
- This is the largest phylum in animal kingdom.
- body triploblastic, bilaterally symmetrical and metamerically segmented.
- They have an exoskeleton made up of protein and Chitin (Moulting → Periodic shedding off of the



Crab

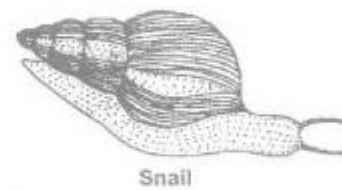
exoskeleton to induce the growth).

- They have a complete alimentary canal with mouth & anus.
- Respiration occurs through general body surface, gills, trachea and book lungs.
- They have open circulatory system with dorsal heart & arteries.
- Body cavity is called haemocoel.
- Excretion by coelomducts, malphigian tubules, green glands, coxal glands.
- Sexes are separate .
- Each segment has paired lateral and jointed appendages. E.g. Palaemon (prawn) , Cancer (crab) , Periplanata (cockroach) , Anopheles (mosquito) & Aranea (spider) etc.

(i) **Phylum Mollusca :**

Characters:

- It is second largest group of animals, body soft, Unsegmented, bilaterally symmetrical and without Appendages.
- Body divided into a head, foot and visceral mass. A Thin skin covering the body is called as mantle, which Secretes a calcareous shell.
- Body cavity is haemocoel.
- Respiration by gills (Ctenidial) in aquatic forms but in terrestrial forms space between mantle and body wall called as mantle cavity act as lungs.
- For ingestion they have tongue like structure "radual" They also possess a digestive gland called hepatopancreas
- Open circulatory system.
- Excretion by metanephridia present near heart.
- Reproduction is sexual and sexes are separate. E.g. Chiton (8 Calcareous pieces) , Pila, Melix (torsion univalve) , Dentalium (tusk like shell) , Unio, Mytilus (Bivalve) , Octopus.



Snail

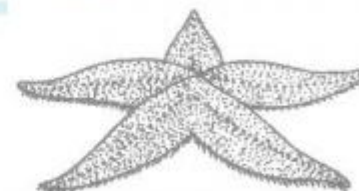


Octopus

(j) **Phylum Echinodermata :**

Characters:

- These are marine animals, their body is triploblastic, Eucoelomata, unsegmented.
- Their body has spines arising from exoskeleton of Calcium.
- Adults are radially symmetrical while larvae are Bilaterally symmetrical.
- Head is absent, oral and aboral surfaces have five Radial ambulacra.
- Excretory organs are absent.
- A complex system of water containing tubes and Bladders passing through pores of skin called water Vascular system is present. From this tube like structure



Starfish

Arise, these tubes look like feet and are called as tube

Feet that helps in locomotion

- Reproduction can be asexual, sexual or by regeneration. E.g. Asterias (star fish) , echinus (sea urchin) , Holothuria (sea cucumber) , Antedon (feather star).

EXERCISE

OBJECTIVE DPP - 10.1

1. A branch of biology which deals with the identification, nomenclature and Classification of organisms is called
(A) Morphology (B) Ecology (C) Taxonomy (D) Phytogeography
2. Who is known as father of taxonomy?
(A) Mendel (B) Linnaeus (C) Darwin (D) Crick
3. Binomial nomenclature was introduced by
(A) John Ray (B) A.P. de Candolle (C) A.L. de Jussieu (D) Carolus Linnaeus
4. The basic unit of classification is
(A) Variety (B) species (C) genus (D) family
5. A group of freely interbreeding organisms constitutes a
(A) species (B) genera (C) family (D) class
6. According to binomial nomenclature, the scientific name of an organism must consist of two words. These are
(A) species and tribe (B) genus and species (C) order and family (D) genus and family
7. Which taxonomic term may be substituted for any rank in the classification?
(A) class (B) Genus (C) Species (D) Taxon
8. Cryptogams include
(A) thallophytes (B) bryophytes (C) pteridophytes (D) all of the above
9. Algae are characterized by
(A) Pyrenoids (B) aquatic habitat (C) unicellular sex organs (D) all of the above organs
10. In Whittaker's classification, unicellular organisms are grouped under
(A) protista (B) porifera (C) fungi (D) protozoa

SUBJECTIVE DPP - 10.2

VERY SHORT ANSWER TYPE QUESTIONS

1. Which is the largest phylum of kingdom animalia ?
2. Name the phylum in which animals have segmented body, coelom, and bilateral symmetry.
3. Name the phylum in which animals have segmented body, jointed appendages and compound eyes.
4. Write the binomial name of any one organism.
5. Name the code which governs the naming of organism

SHORT ANSWER TYPE QUESTIONS

6. Write down four main features of protozoa.
7. Mention the characteristic features of arthropod.
8. How do poriferan animals differ from coelenterate animals?

LONG ANSWER TYPE QUESTION

9. What is five kingdom classification and who proposed it ?

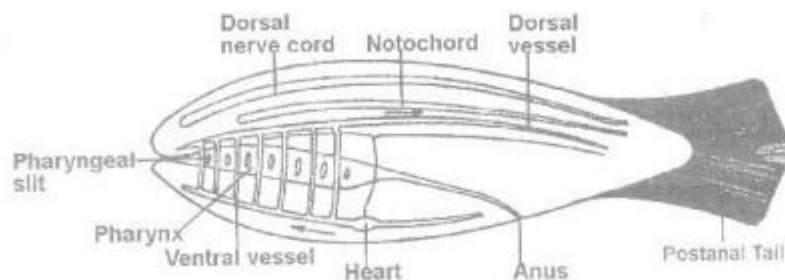
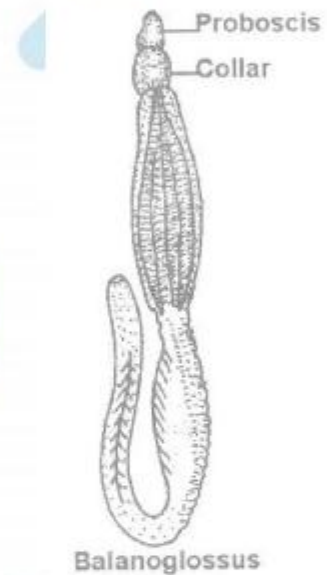
DIVERSITY OF LIVING ORGANISMS

BL-11

PHYLUM HEMICHORDATA

Characters:

- * They are placed in between no chordates and Chordates as they possess some characters of both.
- * They include worm like, unsegmented, bilaterally Symmetrical animals which are exclusively marine.
- * Their body is divided into three regions proboscis, Collar & trunk.
- * They do not possess notochord, which is a flexible, Rod like structure running through the length of the body, Above alimentary canal.
- * They possess gill slit or gill cleft which is meant for Respiration.
- * They possess nerve cord in collar region but it is not a true dorsal cord. E.g. Balanoglossus (tongue Worm).

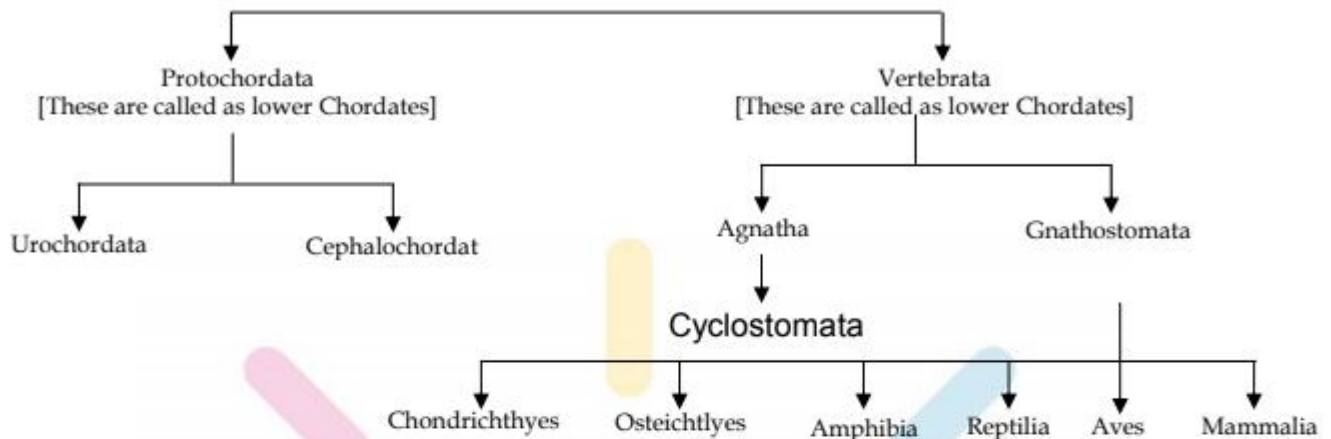


Characters:

- * This is the most advanced group of animals.
- * Notochord is present at some stages of life, supported by a tubular hollow dorsal nerve cord.
- * In higher chordates i. E. Vertebrates, the notochord is replaced by vertebral column.
- * A set of gill slits is also present at certain stage of life, also called as pharyngeal gill clefts.
- * Tail is also present behind the anal aperture that is post anal tail.

- * They also possess a proper circulatory system.

CHORDATA IS FURTHER DIVIDED AS FOLLOWS



(a) Protochordata :

Characters:

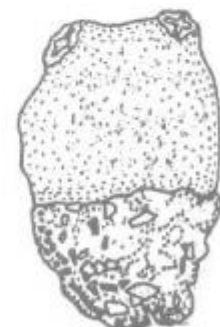
- * They are termed as lower chordates.
- * They do not possess brain, cranium, vertebral column, jaw and paired appendages.
- * Notochord is present atleast in some stages along with other diagnostic chordate characters (dorsal hollow never cord, gill slits, post and tail).
- * They are triploblastic, bilaterally symmetrical, enterocoelomic, organ system level organization.
- * They are marine animals.
- * Protochordata are further divided into two groups :

(i) subphylum : Urochordata

Characters:

They are exclusively marine animals where pharynx possess several gill slits.

- * They are commonly known as tunicates.
- * The notochord is present in the tail of the larva and disappears in the adult.
- * The dorsal hollow never cord is present in the larva only. it is replaced by a dorsal ganglion in the adult.
- * The pharynx has gill slits.
- * The larva (tadpole) undergoes retrogressive metamorphosis, i.e., changes from a better developed larva to a less developed adult. e.g. Herdmania (sea squirt), Doliolum, Pyrosomea.



Herdmania

(ii) subphylum : Cephalochordata

Characters:

- * Animals are fish like without a head.
- * Animals possess all the characters of chordates i.e.,
- * A notochord which extends upto the entire length of

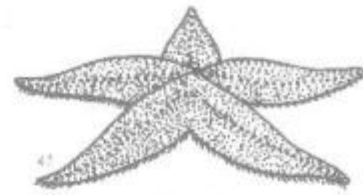


Amphioxus

the body and persists throughout the life.

- * A nerve cord (without a distinct brain).
- * Numerous well developed gill sli
- * A post anal tail throughout life. e.g. **branchiostoma (Amphioxus; Lancelet)**

- * Adults are radially symmetrical while larvae are bilaterally symmetrical.
- * Head is absent, oral and aboral surfaces have five radial ambulacra.
- * Excretory organs are absent.
- * A complex system of water containing tubes and bladders passing through pores of skin called water vascular system is present. from this tube like structure arise, these tubes look like feet and are called as tube feet that helps in locomotion
- * Reproduction can be asexual, sexual or by regeneration. e.g. Asterias (star fish), Echinus (sea urchin), Holothuria (sea cucumber), Antedon (feather star),



Starfish

EXERCISE

OBJECTIVE DPP - 11 .1

- The mode of nutrition in all fungi is characteristically
(A) Symbiotic (B) autotrophic (C) holozoic (D) saprotrophic
- The reserve food in fungi is
(A) starch (B) cyanophycean starch
(C) glycogen (D) glycogen and fat
- The algal partner of a lichen is called as
(A) Mycobiont (B) Phycobiont
(C) Both of the above (D) None of the above
- Pteridophytes are known as
(A) sea plants (B) vascular cryptogames
(C) club mosses (D) horse tails
- Gymnosperms are characterized by
(A) non-motile male gametes (B) naked seeds
(C) Winged seeds (D) true fruits
- Which one is mismatched?
(A) Flagella Euglena (B) Pseudopodia Amoeba
(C) Cilia Paramecium (D) Flagella Plasmodium
- Contractile vacuole is present in
(A) Amoeba (B) Euglena
(C) Paramecium (D) All of the above
- 'Venus flower basket' is the dried skeleton of
(A) Euspongia (B) Euplectella (C) Spongilla (D) Leucosolenia
- Choanocytes are unique to
(A) Protozoa (B) Porifera (C) Mollusca (D) Echinodermata
- Cnidaria is characterised by
(A) nematoblasts (B) coelenteron
(C) tissue level of organisation (D) all of the above

SUBJECTIVE DPP - 11 .2

VERY SHORT ANSWER TYPE QUESTIONS

1. Who is the father of taxonomy?
2. What is taxonomy ?
3. Given one point of difference between bilateral and radial symmetry.
4. Give an example of hemichordata.
5. Herdmania is classified in which subphylum.

SHORT ANSWER TYPE QUESTIONS

Write down the distinct features of chordata.

6. Write down the unique features of hemichordata.
7. What are the main characteristic features of Protochordata?

LONG ANSWER TYPE QUESTION

8. Draw an out line of classification of chordates.

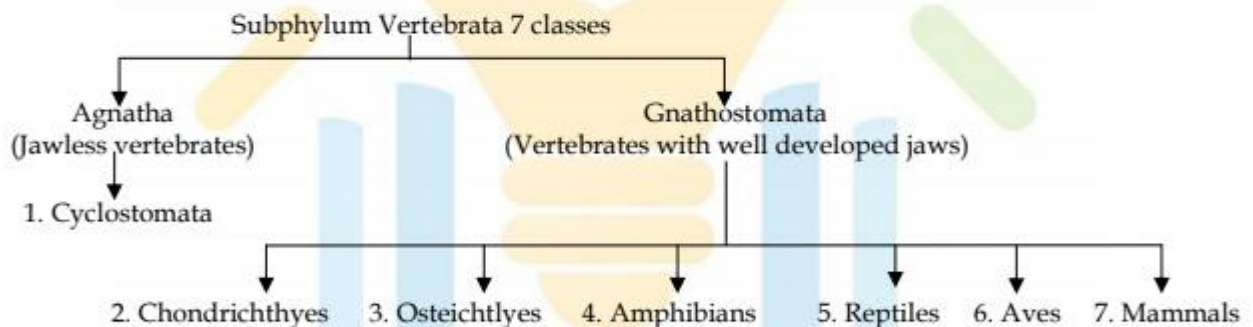
DIVERSITY OF LIVING ORGANISMS

BL-12

SUBPHYLUM VERTEBRATA OR CRANIATA

- * Majority of chordates are included in this phylum.
- * Characters:
- * They are advanced animals, having a cranium (brain box) around the brain. Nervous system is well developed.
- * Notochord is replaced by a vertebral column (backbone) in the adults. Endoskeleton is highly developed.
- * There are two pairs of limbs or appendages.
- * Head is well differentiated.
- * The heart is situated ventrally. The circulatory system is closed consisting of **bold** vascular system and lymphatic system. Red Coloured pigment hemoglobin is present in red blood corpuscles.
- * Respiratory organs may be gills (in aquatic animals), skin, buccopharyngeal cavity (in amphibians) or lungs (in land animals).
- * Excretion occurs through kidneys.
- * Sexes are separate.

This subphylum is subdivided into seven classes. They are:



(a) **Class Cyclostomata :**

(Gr. Cyclos = circular, stome = mouth ; the circular Mouthed fishes) these are the most primitive Vertebrates.

Characters:

- * Animals are jawless and possess a circular mouth.
- * They are ectoparasites on fish and use mouth to stick to fish ; the mouth is therefore suctorial.
- * Notochord is present in the form of a cylindrical rod.



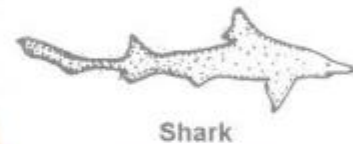
- * Head and brain are poorly developed.
- * Cartilaginous endoskeleton is present.
- * Respiration occurs through gills contained in pouches.
- * Heart is two-chambered consisting of one auricle and one ventricle.
- * Gonad is single and fertilization is external. e.g. petromyzon (lamprey), Myxine (hag fish).

(b) **Class Chondrichthyes :**

(Gr. Chondros = cartilage; ichthys = fish, the cartillagenous fish).

Characters:

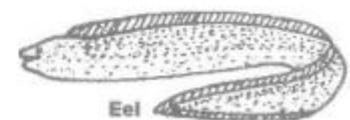
- * Skeleton is **cartilaginous**, hence the name Chondrichthyes is given.
- * The body is either laterally compressed and spindle shaped, or dorso ventrally flattened and disc shaped.
- * Mouth is ventral in position on the head.
- * Jaws are well-developed.
- * Respiration occurs through gills.
- * The skin is covered with placoid scales (exoskeleton).
- * Heart is two chambered, consisting of an auricle and a ventricle.
- * Lung or air bladder is absent.
- * They reproduce by laying eggs (oviparous) or produce eggs which hatch inside the mother's body (ovoviviparous).
- * Fertilization is internal.
- * Mostly marine and large in size (upto 10-20 meters long). e.g. sharks, rays and skates. scoliodon (Indian shark, dog fish), Torpedo (electric ray), Trygon (sting ray), Rhinobatus (guitar fish).



(c) **Class Osteichthyes :**

Characters:

- * Skeleton is cartilaginous, in the embryonic stage, but is replaced by bones in adult form (bony endoskeleton), hence the name osteichthyes is given.
- * Body is generally spindle shaped.
- * The exoskeleton, if present, consists of cycloid or ctenoid scales.
- * The mouth is terminal (anterior) on the head.
- * Gills are covered by bony flap called as the operculum.
- * A swim bladder (or air bladder) is usually present. it helps in floating.
- * Heart is two chambered.
- * Fertilization is mostly external.
- * They live both in fresh and sea water.
- * In size, they vary from 10 mm to 4 meters. e.g.



Labeo, Hippocampus (sea horse), Anabas (climbing perch), Muraena (eel), Protopterus (lung-fish).

(d) **Class Amphibia :**

(Gr. amphi = both, bios = life, the vertebrates leading two lives/ dual life)

- * The amphibians are the first land vertebrates, Amphibious partly terrestrial and partly aquatic.

Characters:

- * They are amphibious in nature ; found in fresh water and moist places.
- * Skin is smooth or rough, rich in glands which keep it moist ; skin with pigmented cells, i.e., chromatophores.
- * Body is without scales.
- * Endoskeleton is mostly bony, notochord does not persist in adults.
- * Head and trunk are distinct ; neck and tail may or may not be present.
- * Limbs tetrapods(four-limbed), pentadactyl type (five-fingered).
- * Respiration occurs by lungs, skin or buccal lining, are present at least during Laval stage for reparation.
- * Heart three chambered with two auricles and a ventricle, red blood corpuscles are large, biconvex, oval and nucleated.
- * Brain is not much developed, cranial nerves are 10 pairs.
- * Sexes are separate, i.e., dioecious, male without copulatory organ.
- * Eggs with gelatinous covering, usually laid in water.
- * Fertilization is external.
- * Development is indirect with a tadpole larva which undergoes metamorphosis to become adult.
E.g. Salamanders, newts, frogs and toads. Salamandra (salamander) , ecturus (mud puppy), Triturus (newt), Rana (frog), Bufo (toad).

(e) **Class Reptilia :**

(L. reptare = to creep ; creeping vertebrates).

- * These are first truly terrestrial animals living in warmer regions.

Characters:

- * Body is divisible into head, neck and trunk. tail is well developed in some, while it is reduced in others.
- * Two pairs of pentadactyl limbs are present ; but in snakes limbs are reduced or absent.
- * Body is covered with epidermal horny scales.
- * Skin is dry, impermeable and devoid of glands.
- * Respiration takes place by lungs only. gills are absent.
- * Heart is incompletely four- chambered, having two auricles and incompletely divided ventricle. in crocodile, heart is completely four chambered.
- * Sexes are separate.
- * Fertilization is internal(characteristics of land animals).
- * The embryo always lies in a fluid filled sac called amnion.
- * There is no larval stage in development. e.g. Testudo(tortoise), Chelone(turtle) Draco (flying lizard), Chameleon, Hemidactylus (wall lizard), Naja (cobra) etc.

(f) **Class Aves :**

(L. Aves = birds).

- * The birds are described as 'feathered reptiles' that have developed the power of flight.

Characters:

- * The body is covered with soft feathers (feathery exoskeleton).
- * The body is divisible into head, neck, trunk and tail.
- * There are two pairs of limbs. the fore limbs are modified to form wings (in flying birds) or are reduced (as in non-flying birds). Hind limbs are strongly developed for perching, walking.
- * Endoskeleton is light. the bones have got air cavities. this makes the bird light.
- * Jaws are modified to form a strong beak.
- * Teeth are absent.
- * Respiration is by lungs only. Lungs have additional bag like membranous extensions called as air sacs.
- * Heart is completely four chambered.
- * Sexes are separate.
- * Birds are oviparous, i.e. egg laying.
- * Fertilization is internal. Fertilized eggs are laid with a yolk (stored food) and with a hard calcareous shell.
- * Like reptiles and mammals, they have the embryonic membranes namely the amnion, chorion, yolk sac and allantois.
- * High degree of parental care is exhibited.
- * There is no larval stage in development. e.g. Columba (pigeon), Pavo (peacock), Corvus (crow), Passer (sparrow), Struthio (ostrich), Kiwi and penguin are flightless birds.

(g) **Class Mammalia :**

(L. mamma = breast; the mammals)

- * Mammalia is the most evolved group of organisms and are found in diverse habitats ranging from deserts, polar ice caps, oceans, mountains, forests and grasslands.
- * They are named mammals as all of them possess mammary glands (milk producing glands) . Mammals are the only animals which feed their young ones with milk.

Characters:

- * Skin is covered with an exoskeleton of hair. Hair are provided with sweat glands which help in the regulation of body temperature. in aquatic mammals, hair being negligible, the subcutaneous layer of fats provides insulation.
- * Mammals have two pairs of pentadactyl limbs.
- * The body cavity is unequally divided into two parts by a muscular partition called as diaphragm.
- * Eyes are provided with movable lids.
- * Ears have fleshy external ears or pinnae.
- * Teeth are embedded in sockets (thecodont). Two sets of teeth develop in the life time of a mammals Milk teeth and permanent teeth (diphyodont).
- * Teeth are of different types (heterodont).
- * Respiration occurs by lungs.
- * Heart is four chambered. R.B.Cs are non nucleated and usually circular.
- * Sexes are separate. Gonads are paired. Testes lie commonly in the scrotal sacs outside the abdomen.

- * Fertilization is internal. Eggs are small, microscopic without shells and are retained in uterus of female for development.
- * Embryonic membranes (amnion, chorion, yolk sac and allantois) present.
- * They give birth to living young ones and are called as viviparous. The young ones are fed on milk from mammary glands.

(h) Important Groups of Mammals :

Mammals are divided into three main groups,

- (i) Egg-laying mammals (monotremes) : These mammals show characters of both reptiles and mammals. They lay hard shelled eggs (oviparous) e.g. spiny ant eater, Duck - billed platypus
- (ii) Marsupial mammals (pouched mammals) : Pouched or marsupial mammals (Latin marsupium = pouch) They are viviparous. The young ones, when born, are only three cm. long. Hence they are cared in pouch called marsupium present on the mother's abdomen. in the pouch, they feed on the mother milk e.g. Kangaroo(Macropus), Kola bear,
- (iii) Placental mammals (true mammals) : These mammals with true placenta. The embryo is retained in the uterus. These are the very successful group of land animals, occurring in diverse climatic condition. e.g. Mole, bat, lion, tiger, camel, giraffe, whale, dolphin, monkey, humans etc.

EXERCISE

OBJECTIVE DPP - 12.1

- Mesoglea is characteristic of
(A) Platyhelminthes (B) Aschelminthes (C) Cnidaria (D) Mollusca
- True jelly fish (e.g., Aurelia) belongs to class
(A) Hydrozoa (B) Anthozoa (C) Scyphozoa (D) Both B and C
- Polymorphism is exhibited by
(A) Hydra (B) Physalia (C) Octopus (D) Crab
- Comb jellies belong to
(A) Scyphozoa (B) Hydrozoa (C) Ctenophora (D) Both A and B
- Platyhelminthes are called
(A) round worms (B) flat worms (C) blind worms (D) none of the above
- In Platyhelminthes, the excretory organs are.
(A) nephridia (B) malpighian tubules
(C) flame cells (solenocytes) (D) green glands
- Platyhelminthes are
(A) coelomates (B) pseudocoelomates (C) haemocoelomates (D) Acoelomates
- The common name for Ascaris is
(A) shipworm (B) pinworm (C) tapeworm (D) round worm
- Metamerism is characteristic feature of
(A) Chordata (B) Annelida (C) Mollusca (D) Nematoda
- The excretory organs of Annelida are
(A) nephridia (B) statocysts (C) archeocytes (D) none of the above

SUBJECTIVE DPP -12.2

VERY SHORT ANSWER TYPE QUESTIONS

- What is Notochord ?
- Give the classes of vertebrata.
- Which is largest phylum of kingdom Animalia ?
- Give an example of urochordata.
- Give the difference between notochord and nerve cord.

SHORT ANSWER TYPE QUESTIONS

6. Mention two points of difference between fish and frog.
7. Describe the general characters of class mammalia.
8. What are the differences between animals belonging to the aves and mammalia

LONG ANSWER TYPE QUESTION

9. What is classification? Explain its importance.

ANSWER KEY

(Objective DPP # 9.1)

Q	1	2	3	4	5	6	7	8	9	10
A.	A	D	A	B	B	C	B	A	D	B

(Objective DPP # 10.1)

Q	1	2	3	4	5	6	7	8	9	10
A.	C	B	D	B	A	B	D	D	D	A

(Objective DPP # 11.1)

Q	1	2	3	4	5	6	7	8	9	10
A.	D	D	B	B	B	D	D	B	B	D

(Objective DPP # 12.1)

Q	1	2	3	4	5	6	7	8	9	10
A.	C	C	B	C	B	C	D	D	B	A